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THE MANUFACTURE OF BRASS CASED AND CLOSE JOINT CASED TUBE.

A DESCRIPTION OF THE PRODUCTION OF IRON-LINED BRASS TUBING AS PRACTICED IN ENGLAND.

BY FELIX FORWARD.

The beds of our forefathers were upon the floor, laid thriftily of rushes. Time and the fashions erected that monstrosity, the mahogany four-poster, curtained around with damask hangings. About as healthy as a diving-bell, and piled ceiling high with successive layers of palliasses and mattresses, finally topping off with a gigantic feather bed which it was necessary to mount by means of a scaling ladder, the pre-Victorian couch was a monument to the stolid respectability and unimaginative taste of those days.

THE COMING OF THE METAL BEDSTEAD.

In course of time appeared the iron bedstead, a creation of weird shapes, modestly enamelled a shiny black, or garishly painted in virulent colors, having an uneasy air of being out of tune with the band. Sir Edward Thomasson, however, in 1803 invented the cased tube. He says: "In watching the operation of drawing brass and copper tubes upon the mandrel, I found it required as much power to slide off the hollow tube from the mandrel as was required to draw it on. Reasoning from the adhesion of the brass tube to the steel mandrel, I found by experiment that the union of copper and iron or of brass and iron could be accomplished by pressure and conceived that such an application would be useful for making copper bolts for shipping, solid brass rods for stair carpets, solid brass to go around the top of a room to suspend pictures, as curtain rods for drawing rooms, and as balustrades for staircases."

It is a curious fact that Thomasson could not, or did not, anticipate the chief use to which his invention was to be put, namely, the manufacture of bedsteads, nor does it transpire what became of his patent. Sufficient for us to know that a very large proportion of the bedsteads made today are built up of brass cased or close joint cased tube; and with reference to Great Britain, both tube and bedsteads originate in Birmingham for the most part. It must be admitted at once that bedsteads thus made are but the poor relations of their more opulent relative the solid brass tube bedstead, of which, however, only a few are made for special orders.

FIRST STEP IN THE PROCESS.

The first process in the manufacture of cased tube is that of rolling up into a tube a strip of iron or steel, so that its edges touch so closely that the joint is merely a fine scratch along its length. This is performed in a small rolling mill, mounting two pairs of rolls, one pair in front of the other, on the same horizontal center, in a double housing. The mill is driven by belt or ropes, and stands immediately in front of a reheating muffle having a bed about 18 feet long. Strips of iron are fed in at the back of the muffle and drawn out at the front, and entered into the first pair of rolls at a low red, almost a black heat. This is an important point, as oxidation, and subsequent scaling, must be avoided if the brass case is to polish up smooth, and free of "crocodile skin" marks.

The first pair of rolls turn up, or cut the strip; the second pair deliver it into the straightening trough, a tube scratchless and unblemished, with a tight-lipped joint. The surface is a blue glaze, resembling tempered steel. As already mentioned, the secret of attainment lies in the careful heating of the strip; all that requires is to take the stiffening out of it.

MAKING THE CASINGS, VARIOUS PROCESSES.

It is outside the scope of these lines to describe the casting and rolling of the metal from which the case is made. Moreover, it is a series of operations perfectly familiar to most readers of THE METAL INDUSTRY. In many works the metal is cast, rolled and made into cased tube under the same roof, thus saving two profits which those manufacturers not so fortunately placed have to pay.

There are three ways in which the brass cases for cased tubes may be made:

Process No. 1.—Soldering up metal of as thin a gauge as will braze. No subsequent mandrelling.

Process No. 2.—Soldering up thicker metal to be afterwards mandrel drawn.

Process No. 3.—Drawing seamless cases out of old brass marine, locomotive or condenser tubes.

PROCESS NO. 1.

Briefly, the operation of making a brazed case consists in cupping or turning up the metal until its edges meet, scraping those edges in order to obtain a clean surface for the solder to amalgamate with, binding with iron iron wire at intervals along the length of the tube, and filling the joint with a mixture of brazing solder and borax. The tube is then ready for the solderer, who passes it slowly through a clean hot fire, gauging the speed so as to cause the solder to run evenly and smoothly. It is important that the joint should be free from solderless gaps and solderous lumps, which involve mending or re-soldering in the

former case, and troublesome filing and probable fracture in mandrelling in the latter. After the iron wire has been removed, and the joint quickly dressed with a file, the case is ready for drawing.

When running on processes Nos. 1 and 2, the metal is, of course, ordered from the mill of brazing quality, and of a width which allows of a number of strips to be cut from one coil or lap as the following figures show:

PROCESS NO. 1.

Finished Diameter of Cased Tube.	Metal Required.	No. of Strips.
⅜ in.	6½ in. x .009	5
½ in.	6 in. x .009	3
⅝ in.	7 in. x .009	3
¾ in.	5½ in. x .009	2
1 in.	7½ in. x .011	2
1¼ in.	9 in. x .013	2
1½ in.	5½ in. x .014	1
2 in.	7¼ in. x .014	1

The brass cases made from metal of such light gauges as above are soldered up in lengths corresponding to the lengths of the "inside" they are to cover, and are not subsequently mandrel drawn. Having been slipped over the iron tube, the tube and case are drawn once through a steel die, and finished to the required diameter. Thus are the brass and iron "firmly attached by pressure," as Thomasson specified, though it is doubtful whether a "hollow tube" of brass so thin as to be easily torn by the fingers ever entered into his philosophy.

PROCESS NO. 2.

Finished Diameter of Cased Tube.	Metal Required.	No. of Strips.	Finished Guage.
⅜ in.	8½ in. x .017	5	.006 inch
½ in.	8½ in. x .017	4	.006
⅝ in.	8¾ in. x .024	3	.0075
¾ in.	10¼ in. x .024	3	.007
1 in.	8 in. x .024	2	.009
1¼ in.	5¼ in. x .028	1	.010
1½ in.	6¼ in. x .028	1	.012
2 in.	7¾ in. x .028	1	.014

that as stated above, some cased tube makers are also manufacturers of rolled metal. Administration charges, comprising directors' fees, rent, rates, etc., are omitted from the costs.

Here are comparative costs of cases made by the three processes described:

Now, as the invoiced cost of the rolled metal alone used in cased tube represents between 40 per cent. and 50 per cent. of the prime cost of the rough-finished articl, it is not extraordinary that the manufacturer concentrates, in economic vein, with a view to cutting down the weight of the case sold upon every tube. This is quite the right course to pursue, within limits, and the limit is reached at Process No. 2. That such a method of cased tube making as Process No. 3 was ever inaugurated is incredible. Nevertheless, so strong an incentive is business jealousy, that the example thus set was followed for a time with frantic emulation. Yet a costing system of the most primitive character should have prevented such an egregious mistake.

A glance at the figures above shows that the metal and works cost of case drawn from old tubes is about 1s. 4d. per pound. The net value of the old tubes, assuming them to be fairly clean locomotive tubes, would be 5½d. to 5¾d. per pound, while the cost of repeatedly drawing, annealing and pickling during the reduction in diameter from about 1¾ ins. to ¾ ins., and in thickness from about 10 to 37 gauge is not less than 10d. per pound, or say 1s. 4d. per pound in all. Everyone familiar with tube drawing is aware of the scrupulous cleanliness and almost scientific accuracy necessary when pulling tubes to gauges as light as those specified above. Bars and holes must be perfectly round and true to size; slackening rolls must be exactly adjusted to give the precise amount of pinch; slipping holes must be a little bigger than the bar, yet a great deal smaller than the tube; to mention only a few of the precautions required in light-gauge tube drawing. Yet cased tube manufacturers deliberately courted all these difficulties in an endeavour to draw

COST OF 100 LENGTHS OF ¾-IN. BRASS CASED TUBE 13 FT. 6 IN. LONG.

Origin of Cases.	Process No. 1. Rolled Metal		Process No. 2. Rolled Metal.		Process No. 3. Old Tubes.	
Starting Gauge.	.009.		.024 or 23 Gauge.		.0065	
Finished Gauge.	.009 Bare (about 34 Gauge.)		.0075 (about 36 Gauge.)		(about 37 Gauge.)	
		d £ s d		d £ s d		
Weight and metal cost of 100 finished cases.....	116 pounds	6½ 3 2 10	102 pounds.	6¼ 2 13 2	96 pounds.	5½ 2 4 0
Manufacturing costs per 100 lengths.....	....	1 10 5	....	1 7 11		4 1 2
Totals	....	4 13 3	....	4 1 1		6 5 2

PROCESS NO. 3.

It is not possible to tabulate Process No. 3. Frequently the old locomotive or condenser tubes which it is intended to draw into cases are thickly coated outside with a lime deposit, and so corroded inside as to make gauging an impossibility. The finished gauges are, however, a little thinner than those in Process No. 2, the ¾-inch size generally measuring .006 to .007.

COMPARATIVE COSTS OF THE THREE PROCESSES.

For the purpose of making comparative costs it is intended to take as a standard 100 lengths of brass cased tube ¾ in. x 13 ft. 6 ins. long. Further, it will be necessary to debit ourselves with rolled brass at the market price of the day, regardless of the fact

tubes as thin as paper to lengths of 13, 14, 15 and even to 16 ft., until wiser counsels prevailed. It may be argued that the results of processes Nos. 2 and 3 are brass cases of the same weight as each other within a few decimal points, and as both have to be drawn to exceedingly thin gauges the costs should not show such a wide variation. But Process No. 2 *starts* at a gauge which is just midway in the production of No. 3, and begins, moreover, with a brazed tube of a definite length, a known gauge and weight, and composed of new metal which is finished in a few passes with a minimum of scrap.

There can be no doubt, then, that the cased tube manufacturer has to accept one or both of the remaining methods. Both show a fair profit with discounts

at 72½ per cent., 10 per cent. and 5 per cent. off list, though the balance is in favor of No. 2 if considered solely as a cased tube proposition. But the question is largely modified by outstanding conditions. Most manufacturers of cased tubes also make brazed and seamless brass and copper tubes for general purposes as well as plain and ornamental tube for lamp, chandelier and fender work.

If volume of business or low prices, or both, are against the cased tube trade at the moment, and assuming trade in his other branches to be normal, it would probably be to the advantage of the manufacturer to resort to Process No. 1 for his cased tubes, and switch all available draw bench and attendant strength onto his other lines, such as seamless brass and copper tubes, fender mouldings, and so forth. And herein lies the strength of the wide-awake manufacturer. In cultivating one line only—such as the subject matter of this article, for instance, he courts extinction at the hands of his competitors, who would quickly cut prices to such an extent as to bring him to a standstill. Undoubtedly his commercial salvation lies in an output of wide variety.

The net value of 100 lengths of cased tube, ¾ in. rough, that is, not scoured, nor polished, nor lacquered, is £8 12s., with discounts at 72½, 10 and 5 per cent. off list. The cost of 100 lengths of rolled iron tubes for insides is approximately £2, so that the total cost (not including administration charges as already explained) of our standard 100 lengths is, by Process No. 1, £6 13s. 3d., and by Process No. 2 £6 1s. 1d., leaving balances of £1 18s. 9d and £2 10s. 11d., respectively, to cover administration charges and profit.

From these figures it will be understood that no fortunes are being made out of brass cased tube. Still, makers can secure a fair return on their capital as long as discounts do not rise above their present level. Those manufacturers who, in addition to casting and rolling their metal, have installed a plant for making close-joint iron tubes for insides, are in the enviable position of saving profits which are paid by their less fortunate competitors who are compelled to buy their material.

QUALITY OF SOLDER USED.

It would not be amiss at this point to mention the importance of using a carefully selected grade of brazing solder. In many works it is the custom to buy the cheapest that will braze a joint, regardless of the color or tenacity of the joint made by it. If the brass cases are intended to be mandrel drawn after brazing, a hastily chosen, cheap solder is certain to be at the bottom of a large percentage of the split and defective joints that result. Solder, of course, has a lower melting point than the rolled metal, but the closer these fusing points approximate the more perfect the brazed joints will be.

PROFITS DERIVED FROM FINISHING PROCESSES.

In considering brass cased tube from the point of view of profit and loss, we have so far treated of the tube in its rough state. In the subsequent processes of scouring, polishing and lacquering, the manufacturer may find three sources of profit, more or less. Scouring is necessary, in the case on unmandrelled tubes at all events, to lay the foundation for a fine polish by removing all traces of previous workmanship. Soldering, dressing and mandrel-drawing all furnish undesirable marks of identification which disappear under the scouring mop and the simultaneous application of a fine sand. A well-scoured tube should have the black spots lifted out of it and bear the appearance of having been thoroughly well emery-papered. To revert again to the method of making brass cases, it is noteworthy that by Process No. 2 such an improved case is obtained after mandrelling that the piece-work rate for scouring is half that for cases made by Process No. 1. The net extra earned for scouring our standard of 100 lengths of ¾-in. tube is £1 1s., and the works cost should show a profit between 20 and 25 per cent.

It is to be feared that too many manufacturers in Great Britain are slow to seize upon and develop improvements in methods and means which they have come to regard as inevitable, otherwise more attention would be paid to the automatic machinery now so commonly met with in the United States, for scouring and polishing. Enterprise in the direction of new plant for this purpose would soon transform what is in some cases a loss, or at best a small trading profit, into a handsome return, and it is now to the three finishing processes of scouring, polishing and lacquering that the manufacturer has to turn to effect economies of any magnitude in cased tube making.

One type of automatic machine extensively used in America dispenses with the necessity for scouring, and is capable of turning out, under the hands of one workman, 2,500 to 3,000 ft. of polished tube a day. As the tube passes through the machine, it is successively operated upon by mops of increasing fineness, set at the correct angle, until it emerges polished and ready for the lacquering room.

A still more efficient design, during a recent test polished 36,000 ft. of cased tube in 6 consecutive days of 10 hours each, with one unskilled man in attendance. The cost per foot of polishing under such conditions would not be much more than half that of scouring and polishing with the hand-fed machines in general use in this country. The net extra earned for polishing 100 lengths of ¾-in. cased tube is £1 12s. 9d. The work costs by the old-fashioned method about £1 5s. Assuming the output of the automatic machine last described to be only one-half what is claimed for it; then it would earn £3 12s. 9d. per diem, thus:
100 lengths ¾-in. cased tube x 13 ft. 6 ins. = 1,350 ft. earns £1 12s. 9d.

$$\frac{3{,}000 \times \text{£1 12s. 9d}}{1{,}350} = \text{£3 12s. 9d.}$$

Against this is to be set the wages of one man, mill power costs, mops, composition, etc., which may be estimated at £1 5s. to £1 10s.

LACQUERING.

It is true that lacquering does not offer a large field for improvements; but quite a respectable margin of profit is shown at this operation. The difference in extras earned by tubes polished, and polished and lacquered, is 16/9 per 100 lengths of ¾ in., and the work is cheaply done by female labor. From 25 to 35 per cent. should be available for administration charges and profit. To those who do not use cold lacquer, but pin their faith upon the hot-dried variety, a word of warning may be useful. Recent investigations have shown that the streaky and discolored surfaces frequently met with in the lacquered tube are caused by too high a temperature during the application of the lacquer or immediately afterwards. The correct temperature lies between 100 and 120 degs. F.

NEW AND NOVEL METHODS.

From time to time the industrial world is startled or amused by the announcement of a new method of manufacture, which is to revolutionize existing ones, and incidentally make the fortunes of its promoters. The cased tube trade has not escaped attack. Perhaps the only scheme meriting a brief description was launched by a few enthusiasts having an acquaintence with the process of electro-brassing. A sample of their manufacture lies before the writer, and it must be admitted that it would be difficult to improve upon it. The fine, smooth finish seems to indicate the expenditure of a good deal of filing or similar preparatory labor upon the iron tube forming the inside. Its joint is a brazed one, necessarily. The close joint tube in use today would have admitted the liquor, and a deposit would have formed upon the interior as well as the exterior surface.

The tubes were plugged at both ends, and 64 plated at a time. A 400-ampère machine first deposited a film of copper upon the iron tubes, which were then removed to another tank to be electro-brassed. The surface was so satisfactory that only polishing was necessary to obtain the admirable finish the tube presents today, after many years. A touch or two of a fine file clearly shows that both deposits—the copper and the brass—have been excellently manipulated, and that the copper has truly amalgamated with the iron and the brass. Heating and jarring with a hammer fails to loosen the coatings.

same price as ½ in. on account of the difficulties met with in manufacturing so small a size.

The uses to which close joint and brass cased tubes are put are very similar. Probably the bulk of the close joint tube made is worked into the cheaper class of bedsteads now so common—the variety figuring in the furniture of the £50 villa—where its presence may be detected by the lightness and generally unsubstantial build of the bedstead, or by the simple expedient of feeling for the joint, always to be found on the underside of the tube, with the finger nail. Close joint cased tubes are lighter than brazed cased by about 25%, and for this reason, and their cheapness, are preferred for decorative work and for shopfitting. Needless to say, they do not so readily lend themselves to bending and shaped work, though curves can be got on them by keeping the joint inside the bend.

SOME DETAILS OF MANUFACTURE.

Before the present pitch of perfection was attained in rolling steel and iron strip, the insides for close joint cased tube were cut from steel sheets. This necessarily restricted length, but as bedstead makers customarily standardize their requirements and order large quantities of the same size and length, it was not such a drawback as would appear at first sight. For example, a length in great demand among bedstead makers is 4 ft. 3 ins. Sheets could be obtained of such a size that they could be sheared into the required widths with a minimum of scrap, and of such a superfine finish that

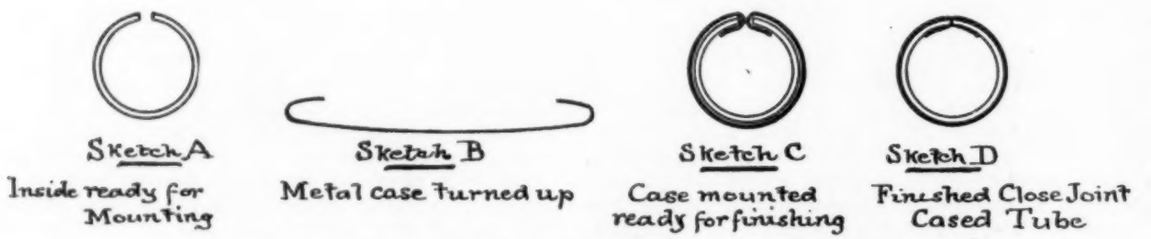


DIAGRAM SHOWING METHOD OF MANUFACTURE OF CASED TUBING.

It is not necessary to explain that the costs of manufacture by a process involving the use of brazed iron tubes, and a delicate electro-metallurgical system, soon proved prohibitive, and the method was abandoned.

Perhaps no field in the manufacturing world offers more inducements to, and is more thoroughly traversed by the restless activity of the inventor, than that offering the accomplishment of the "cheaper substitute." A brief survey of the industrial world provides a list testifying as much to unremitting patience and keen business acumen, as to concessions to the increasing demand by the public for cheapness at any price, a demand which, it must be admitted, manufacturers are only too eager to satisfy. The evolution of the close joint cased tube must necessarily have been long and tedious. To convert a flat strip of steel, and a tape-like length of exceedingly thin rolled brass into an attractive looking picture rod or bedstead rail is no simple proposition; yet it can be achieved in the process of a few easy operations; with but small expenditure of power; and within the confines of a moderate sized room. There is not much demand for close joint cased tube above ¾ in., diameter. Most of that made is ⅝ in. and ¾ in., though manufacturers' price lists quote a range from ⅜ in. to 1¼ ins. diameter inclusive. Three-eighth inch is charged at the metal a "point" thinner than it is customary to employ could be used, and a satisfactory polish obtained. This method will be referred to later. The accompanying table gives details of strip and metal required for close joint cased tubes from ⅜ in. to 1 in. diameter, inclusive.

Diameter.	Dimensions of Strip.	Metal Required.
⅜ in.	1 3/32 in. x 20 gauge bare	1½ in. x .003
½ in.	1 17/32 in. x 20 gauge bare	2 in. x .003
⅝ in.	1⅞ in. x 20 gauge bare	2⅜ in. x .003
¾ in.	2¼ in. x 20 gauge bare	2 13/16 in. x .003
⅞ in.	2⅝ in. x 19 gauge bare	3¼ in. x .004
1 in.	3 1/16 in. x 19 gauge bare	3 11/16 in. x .004

A glance at the sketches below will explain the methods employed in the manufacture of close joint cased tube. Sketch A shows the steel inside ready for mounting upon. E is a sketch of the metal case with ends turned up ready for stretching. C shows case mounted upon the inside ready for finishing, and D is the finished tube.

The strip is supplied of the required width in coils of about one hundredweight each, and until recently was almost wholly of foreign manufacture. British makers have now laid themselves out to cater for this trade, however, and home-made strip can be bought with a surface quite the equal of the foreigner's at a price which compares favorably. The hundredweight coil is swung

upon a drum, and strips cut off in lengths as wanted. The lengths are tagged and drawn successively through cupping and closing rolls, from which they emerge with a slot perhaps 1/16 of an inch wide, running truly down the tube. This operation is, of course, performed cold.

Such is the perfection which has been attained in hot rolling insides for brazed cased tubes, the details of which were described in the first part of this article, that it is usual to examine the tubes and select and put aside for close joint cased tube those of which the surface resembles the smoothness of the cold rolled finish. The economy of this method will be apparent when it is known that hot rolling strip is cheaper than cold rolling by about £2 per ton. The metal is yellow metal, and with best selected copper at about £63 per ton, costs the buyer in the neighborhood of 8¼d. per pound in rolled widths, that is, with ragged edges unsheared. The slitting of this thin metal into the required sizes so as to insure unbroken edges and invariable widths, is an operation requiring skill and experience. "Shark's tooth" or cracked edges are an unfailing source of annoyance and expense in the two processes previous to mounting.

The first consists in drawing a strip of metal—the metal having been previously cut and annealed—through a tool which turns up both ends, as shown at sketch B. This may be easily done by hand, as of course, no pinch can be put upon unsupported metal as thin as that used in close joint cased tube. The turned up strip is next secured at both ends and slightly stretched, which has the result of bringing the rounded ends of the width together, roughly in the form of a tube. It is at this point that the quality of the metal, and the workmanship put upon the slitting is tested. Cracked edges invariably mean broken cases, and although the broken pieces are mounted and finished, a higher percentage of scrap necessarily results when cutting lengths to order out of tubes so treated.

The case is now ready for mounting upon the inside, which is accomplished by hand, by pushing it over the end of the inside, so that the slot receives the turned up ends of the metal. See sketch C. It is important that the case be not too slack or "baggy," otherwise the finished tube presents wrinkles at or near the joint, which quite spoil its attractive appearance. Finishing is done by drawing the inside and case through a malleable iron die of the customary bell-mouth design, but having the hole with a bearing extraordinarily long, often as much as five inches. This insures the closure of the slot in the inside by the simple expedient of enforcing "permanent set" while the tube is in prolonged compression and slight tension during its passage through the die.

To the observer, it is often a source of wonderment why the behavior of metals, so entirely different in character and in substance, should under such strenuous circumstances be so complacent; and surprise is felt that brass so fragile is not torn apart, or severed by the sharp edges of the slot. The fact is, provided the case is a good fit, it follows the universal law and takes the line of least resistance, and so is crowded into and through the slot before the latter's permanent closure. It is when the case is baggy that it becomes contumacious and either wrinkles or rips. It is true, there is another source of the unsightly wrinkle, and that is, a local depression of the edge of the slot caused by a bend or kink in the strip, which it is impossible to correct during the cupping and closing operations. Well made close joint cased tube should be perfectly round and smooth, and show a tight hairlike joint, lying truly along the tube, in one plane. The loose ends of the metal should be neatly folded back against the inside of the tube, as shown at sketch D. This discourages attempts on the part of the mops to pull the metal out of the joint and away from the tube during polishing.

The discounts off close joint cased tube are 10% and 5% higher than off brazed cased, and lately stood at 82½, 10% and 5% off list prices. Comparing the invoiced price of our previous standard with 100 lengths of ¾ in. close joint cased, we find a balance in favor of the "cheaper substitute" of £3 5s. 10d. or £5 6s. 2d., against £8 12s. A difference in net sale prices of between 30 and 40% naturally suggests compensating cheapness in manufacturing costs and materials; and we have already pointed out the fact of close joint tube being 25% lighter than cased tube.

The works and material costs of 100 lengths of ¾ in. close joint cased tube, 13 ft. 6 ins. long, is as follows:

	£	s.	d.
Insides	1	17	—
Rolled metal, 50 lbs.@8¼d.....	1	14	4
Manufacturing costs per 100 lengths..	2	14	—
	£4	5s.	4d.

£4 5s. 4d. is the cost, inclusive of insides, but not including administration charges. This figure is comparable with £6 13s. 3d. and £6 1s. 1d. the costs of manufacture and material of brazed cased tubes by processes Nos. 1 and 2 respectively. A study of these costs emphasizes the necessity for constant watchfulness on the part of the work's management, in order to insure the employment of a minimum thickness of metal in making the case; already the metal cost is about 40% of the prime cost of the rough finished tube, and the subtle intrusion of so insignificant an addition as "half a point" quickly makes itself felt in the profit and loss account.

The manufacturer whose business does not include the casting and rolling of his own brass is at a disadvantage, not only in that his metal costs him more, but also because of his inability to rely upon delivery of his close joint metal with absolutely no increase in thickness over the ordered dimensions; a matter of no small significance as has been shown. In a works supplying brass strip to its own tube shops, it is customary to insist upon any deviation from gauge being by way of reduction therein, and such a regulation can, of course, be enforced; whereas, metal bought from an outside manufacturer is sold subject to a certain variation above or below the ordered gauge, as working accommodation. Needless to say, the higher accommodation is the margin most generally filled.

It goes without saying that attempts are made from time to time to put close joint cased tube upon the market cased with thinner metal than shown in the standards tabulated above. Such mistaken economy generally brings its own punishment in the shape of an abnormal increase in scrap percentages at the benches, a goodly crop of ineligibles in the polishing shop and "small profits and quick returns" from customers. To use metal measuring .002 inch instead of .003 inch is certainly alluring, regarded solely from the metallic weight point of view, and on our standard of 100 length of ¾ in. shows a saving of nearly 15%, a handsome profit in itself.. But this, good as it is, is more than swamped by the disasters consequent on the use of metal so thin. When insides for close joint cased tube were made from sheet, it was practicable to use .003 inch metal on such large sizes as ⅞ in. and 1 in. diameter, on account of the superior finish of the sheet. But the surface of the steel strip now in common use, while improved

out of all knowledge during the past few years, does not permit of the use of thinner metal than .004 on the bigger sizes, economically.

The available margin between works costs and invoiced prices of scouring and polishing close joint cased tube is a handsomer one than that of brazed case tube. Little or no scouring should be necessary if the metal has been cleanly annealed. The net extra earned for polishing 100 lengths is the same as for brazed cased tube, viz.: £1 12s. 9d. and assuming scouring to be unnecessary, something like 50% of it may be set aside to pay administration charges and provide profits.

While to employ automatic polishing machinery is so obviously the right policy to pursue where brazed cased tube is concerned, it is by no means so well adapted for close joint cased tube. The somewhat drastic treatment dealt out to a tube as it passes through the succession of mops would, when applied to such a fragile covering as .003 in. metal, most probably result in more wasters than good ones. As already pointed out, the available margin is a broad one, and on the principle of letting well enough alone, manufacturers would be wise not to disturb established methods in this instance.

The figures given for receipts and costs in lacquering brazed cased tube apply equally well to close joint. It is not improbable that minor improvements in close joint cased tube manufacture may occasionally disturb, in a mild way, the regularity of its processes, but as one may say, its bones are set. It is not anticipated, therefore, that manufacturers will afford much time and attention to a method, patented in the United States, of coating iron with brass. According to this invention, when the iron is hot, a thin coating of pulverized glass is applied to it, which melts, and coats the entire surface. The brass is then applied in a melted condition, or, to use the words of the inventor, "It may be sprinkled in small particles over the surface." The compound metals are then rolled.

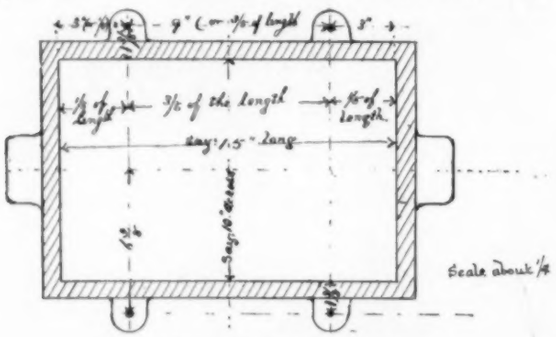
The behavior of metals on both sides of the Atlantic is known to be erratic, and even astonishing—under the hands of inventors. It would be interesting to learn to what uses it is proposed to put this invention, and the measure of success it has won.

To forecast the future in store for the brazed cased and close joint cased tube trades in Great Britain is impossible. That continued and enlarged combination among manufacturers is vital to the welfare of all of them will not be denied. The spasms of unorganized competition frequently experienced in the last decade alternated with profit-earning periods during which prices were controlled by a strong and united association, periods all too short for the more restrained and thoughtful among its members. That such an association, guided by intelligent and practical business men, may be established upon a permanent basis, is the desire of all well-wishers to the brazed cased and close joint tube trades.

A SUGGESTED UNITED STATES STANDARD FOR FOUNDRY FLASKS.

By M. W. G.

In view of the evident need for a standard size of foundry flasks, I have endeavored to outline a scheme which, if adopted, would be of great service to anyone interested in jobbing work. My idea, as expressed in the sketch here shown, is to make all measurements as to list sizes on the inside at the parting line, and the sizes listed at the full half-inch found next below the actual measurement. (To illustrate: Should the actual width be 12⅝ ins. and the length, say, 14 3/16 ins., it must be listed as 12½ by 14.) The location of the pin holes are not to be made from the actual



SUGGESTED STANDARD FLASK.

measurement of the flask, but from the list size as same is provided for above.

In locating the pin holes, the measurements must be made from lines drawn at right angles through the actual center of the flask, and the distance apart along the sides of the flask from center to center of the pin holes must be exactly three-fifths (3/5) of the list length (or 3/10 from the actual center line). The distance apart across the flash must be exactly 3 ins. (3") greater than the list width, or 1⅜ ins (1⅜") more than from the center line to center of pin holes, because it registers almost exactly with 35 millimeters (3½ centimeters) which point is a good practical location, as now generally used. The reason for making the distance along the sides between centers in fifth parts is that sooner or later the metric system will be adopted. For flasks of less than 500 sq. ins. of surface-measure the pin holes must be exactly ½ in. (½") in diameter. The above applies to flasks of all depths.

SILICON AND IRON IN ALUMINUM.

It is of great importance to understand the behavior of melted aluminum in the presence of fluxes. The carbonic alkalies, as soda and potash, and the sulfate alkalies, as Glauber's salts, oxidize at once; borax and silicic acid salts are decomposed by the aluminum, and the boron and silicon form an alloy therewith and make it gray and brittle. The least hurtful are cryolite and ordinary cooking salt.

The first, however, dissolves aluminum slightly, forming a subfluorite of aluminum that is rich in the latter metal; and cooking salt evaporates too easily; so that it is best to use for pure aluminum no flux at all. In melting aluminum with silicates there may be formed compounds containing as much as 70 per cent. of silicium. With only 1 to 2 per cent. of this metal the alloy is gray; in a cold state remaining soft and tough, but hardly forgeable when hot; and with more than 2 per cent. it is brittle. One part of the silicium is chemically combined with the aluminum and in solution has partly separated, as silicate of hydrogen (smelling somewhat like phosphoretted hydrogen) and partly going into the solution as silicic acid. The main portion of the silicium is not chemically combined, in the same manner as carbon in iron, only physically dissolved or held in flakes in the mass. For forging and rolling, small percentages of iron, and especially of copper, are much more harmful than silicium.—Robert Grimshaw.

THE MANUFACTURE OF WROUGHT BRASS.

A Description of Modern Methods in the Production of Plate, Sheet, Rod, Wire and Tube.

(Continued from August.)

By L. J. Krom.

After the "gate" has been cut off, the clean-cut edge of the bar is closely examined for dross, shrinkage spots or blowholes; if any are discovered the metal is cut again, and this is continued until the bar is seen to be sound and clean metal. If it is desired to analyze the daily output of metal, and this is being done more every day in the most up-to-date mills, now is the best time to take the sample. I have found it to be the best check on the caster and the metal to analyze the metal directly back of the "gate." As the "gate" contains the metal that was in the bottom of the pot, the analysis of this portion of the bar will show very readily just how well the mixture has been made. The samples are taken then, after the gate has been cut off, and by running the tests during the night the results are known the following morning and in time to arrest and return any bar that does not prove to be up to the required standard. Of course, while it is a practical impossibility to analyze every bar cast, if one or two samples are taken each day for each kind of mixture cast, a very fair indication of the metal turned out can be obtained; another point being that if the melting force is aware that the metal is being tested they are very apt to be more careful in the mixing operations. Also metal that is not up to requirements can thus be checked before expensive work has been done on a distorted mixture.

Following the cutting off of the "gate," the bars are then cut to handling lengths. In most plants this is of a weight that the average mill laborer can handle without difficulty. We will find bars running from 60 to 100 pounds being used in the various mills. For long, narrow widths of metal this allows of three bars to the pot, and for the wider ones two to the pot. After the bars have been cut to proper length, they are piled on the wagons again and reweighed. The loss of weight is due to the "gates" and "bad" metal. In some shops the caster is not charged with the gate metal, only the weight of "bad" is deducted from his gross weight and he is paid on the hundred-pound basis for the net. In a few places, however, he has to stand the loss of all metal not delivered to the mill.

A method of compensation now coming into practice in the brass business is to pay the caster so much per day, a day's work being whatever is agreed upon at the start and allowing him a certain amount pro rata for every round over the stipulated number. Helpers are also supplied to him by the firm and he is relieved of practically any responsibility regarding the efficiency of his help; the old system being to pay the caster either so much for every pot poured or so much per hundred pounds of metal delivered to the mill. This made the caster responsible for all of his operations, as he had to furnish and pay his own help. He was charged with materials used, both metals and apparatus, due allowance being made for material consumption and shrinkage, and was paid for stock delivered to the mill.

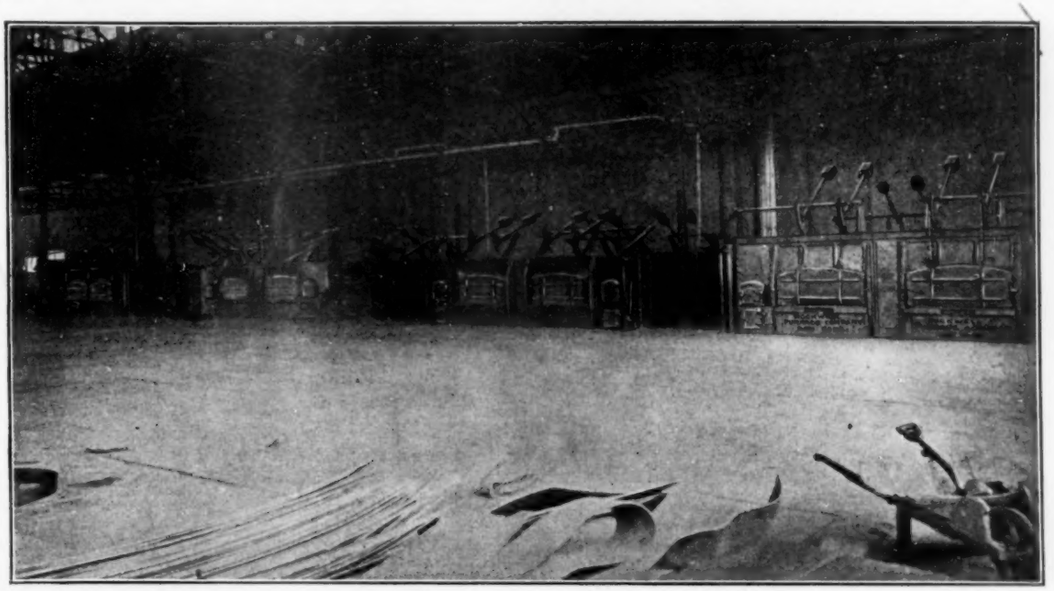


FIG. 6.—BRASS ANNEALING FURNACES, MANUFACTURED AND INSTALLED BY ROCKWELL FURNACE COMPANY, NEW YORK.

THE METAL IN THE MILL.

The bars of metal, after being cut to the right length, are marked as to their respective mixture, which usually goes by number and size. They are then piled on long iron pans resting on wagons built for the purpose. The wagons, which usually hold a day's work each, are then taken to the annealing furnace of the type shown in Fig. 6, and the pan, with its contents, is drawn off the wagon into the furnace. The metal is heated to a rosy red by means of wood, hard coal or oil, all three fuels now being in use. The annealing process for the newly cast metal usually is performed at night when the muffle is not being run at full heat all night. If the mill is running double shift, then the new bars are treated for a definite length of time, generally two hours, when they are withdrawn and allowed to cool slowly out on the mill

floor. If the mill runs only in the daytime, or has muffles to spare, the bars are left in practically all night and allowed to "soak," being withdrawn early in the morning and in time to allow for cooling before the rollers are ready to start the rolls. The difference between the two methods can be charged partly to sentiment on the part of the mill manager, and partly to the fact that longer annealing produces a more uniform composition, but this latter depends considerably on the mixture.

ROLLING THE METAL.

The first operation in the reducing of wrought brass is known as breaking down, and consists in passing the bars between chilled steel rolls, from 20 to 30 inches in diameter, and 30 to 36 inches wide, revolving at from 15 to 20 revolutions per minute. We show a pair of these rolls in Fig. 7. The cast bars of brass are usually 1⅛ inches in thickness. The general practice in the rolling of these

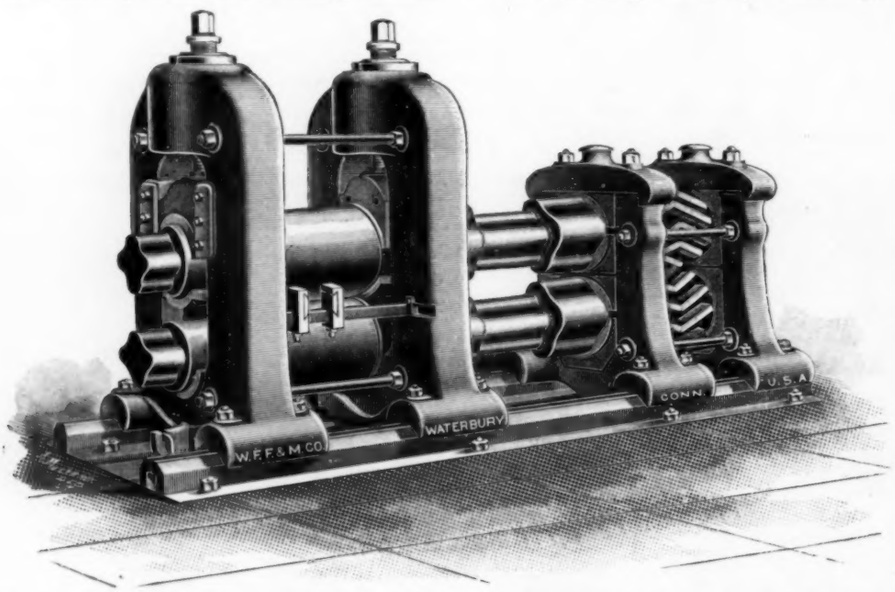


FIG. 7.—20-INCH "BREAKING DOWN" ROLLING MILL, MANUFACTURED BY WATERBURY FARRELL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

bars is to reduce the bar in "breaking down" from the original thickness of 1⅛ inches to ¾ or ⅝ of an inch in three "passes." This is accomplished by taking off from ⅛ to 3/16 of an inch in each pass. The amount of reduction a punch on each pass varies of course with the width of the metal and also with the mixture of the brass.

This operation of "breaking down" is done with cold metal, as are practically all of the rolling processes in the manufacture of brass.

OVERHAULING.

After the bars have passed the "breaking down" rolls they are ready for the "overhauling" process. This is done by the aid of the machine shown in Fig. 8, a description of which was published in THE METAL INDUSTRY for June, 1910. The machine has a table which is moved forward and backwards, and also can be raised up and down at the will of the operator who sits beside it. The bar of metal is placed upon the table and securely clamped in place. When the machine, which is either belt or motor-driven, is set in motion, an arm carrying a specially shaped tool is moved rapidly forth and back over the surface of the bar of metal. The table is then raised by means of a hand lever or wheel until the edge of the tool touches the metal on the back stroke. Small chips are then scraped from the surface, thus cleaning it and taking out all dirt, dross or other foreign matter that may have become imbedded. The operation of "overhauling" is complete when both sides of the bar have been scraped clean. Should any particles of iron be discovered in the bar they are usually chipped out with a cold chisel if small; if large and near the end of a bar, they are cut up by shearing off the end, but if near the center, the bar is usually condemned as scrap.

The amount of metal taken off a bar by overhauling in relation to the gross weight varies in different mixtures of brass and in different mills. Leaded mixtures and those made of mostly scrap are overhauled more deeply than the metal made of new material and intended for purposes requiring a high grade of brass or bronze. In most cases, however, the loss in weight in "overhauling" is rarely under 3 per cent., and runs

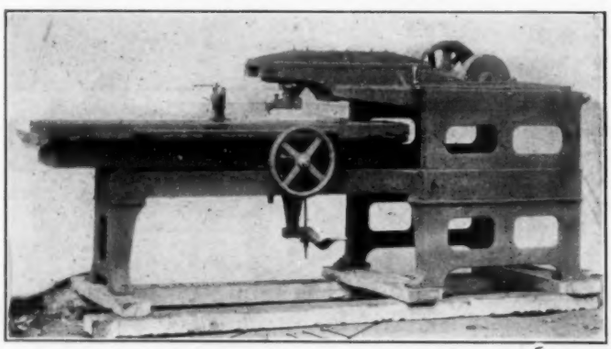


FIG. 8.—BELT DRIVEN OVERHAULING MACHINE, WATERBURY FARRELL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

in some cases to as high as 7 per cent. of the gross weight of the bar. The chips are carefully collected and kept separate as to mixture and returned to the casting shop for remelting with new material. The overhauled bars are now sent to the annealing furnace and given another heating in order to soften the surface for the further rolling operations.

(To be continued.)

THE ELECTRIC EXTRACTION AND REFINING OF THE NON-FERROUS METALS

ALUMINUM AND COPPER.

BY JOHN B. C. KERSHAW.

INTRODUCTION

Electric methods have been widely employed in the extraction and refining of the non-ferrous metals, and few of the metals named in the sub-title of this journal, pass today from the state in which they are found in the ore to the finished metal, without owing something to electricity. It is the purpose of the writer in this and the following articles to explain in non-technical language the application of electricity in the production of aluminum, copper, gold, lead, nickel, silver, tin and zinc, and to trace the development of the electro-metallurgical industries founded upon these new processes. The applications of electrolysis in the extraction and refining of these metals is, however, a large subject, and only a bare outline of the processes, and a slight sketch of the present industrial development of the same, will be possible within the limits assigned to this series of articles. Readers who require a more detailed treatment will find it, in the hand-books—named in the appendix.

ALUMINUM

Although the metal aluminum was discovered by Wöhler in the year 1828, and was first prepared electrolytically by Gore in 1850, it was not until the closing years of the nineteenth century that the use of electricity in the production of aluminum became of industrial importance. Gore had used the fused chloride for his experiment in 1850, and by electrolysis of this salt had obtained the metal at the negative pole. It was found at this date more economical however, to prepare the metal by chemical means, and until the advent of cheap electric power and of the Heroult and Hall processes of manufacture, metallic sodium was employed to decompose the chloride of aluminum. A large works was erected at Oldbury, near Birmingham, in 1887-1888, to carry on the production of aluminum by the most successful of these chemical processes of manufacture (that of Castner and Webster). This works, the property of "The Aluminum Company," was obliged to suspend operations in 1891, the exploitation of the electrical processes having been marked by a reduction of 75 per cent. in the selling price of the light metal.

In that year the total output of aluminum was estimated to be 324 tons, and the price dropped from 8s. 4d. ($2.00) to 2s. 1d. (50 cents) per pound. At the present date the annual output of aluminum is estimated to be 30,000 tons, and the price of the metal has fallen to 7½d. (15 cents), per pound. When one recalls the fact that down to the year 1886 the metal was sold at 3s. 6d. (84 cents) per ounce, was practically a laboratory curiosity; and had no applications in the Arts or Industries; the progress made since the advent of the electrolytic methods of manufacture is certainly remarkable.

The two processes of manufacture which have transformed aluminum from a rare metal, into a rival of copper and tin were patented and developed independently by Heroult in Europe and by Hall in America about the same date (1886-1888), and in all essential details these processes are alike.

Alumina—the oxide of aluminum, is prepared in as pure a state as possible, and is dissolved in a bath composed of the molten fluorides of sodium, aluminum and calcium. When an electric current is passed through such a molten mixture, using carbon electrodes, the aluminum oxide is decomposed into its elements, and aluminum collects at the negative pole—in the molten state—while the oxygen combines with the carbon of the positive pole and escapes as carbon monoxide or carbon dioxide gas. The success of the process is largely due to the fact that molten aluminum is heavier than the fused mixture of salts which forms the bath, and the drops of metal clinging to the negative pole therefore fall to the bottom of the bath, where they are protected from oxidation by the depth of fused salt above them. Had the molten aluminum been lighter than the fused salt mixture in the bath, the drops of metal would have risen to the top and would have quickly oxidized, since aluminum has a great affinity for oxygen.

Much secrecy has been observed by the aluminum companies regarding the practical working details of the process of manufacture, but the following description by Professor Richards, of Lehigh University, South Bethlehem, Pa., gives the main features of the Hall process, as operated at Niagara Falls in the nineties:

> The baths are of sheet-iron, lined with carbon, and are oblong in shape. The current passes into each bath or "pot" by carbon electrodes, each 3 ins. in diameter and 18 ins. in length, suspended from a copper carrier bar running longitudinally over the bath. The "pots" are worked in series, and the drop of potential at each "pot" is 5 volts. Each "pot" absorbs about 65 h. p., and produces about 112 lbs. aluminum per twenty-four hours. The electrolyte is kept at the necessary degree of fluidity (850 degs. to 900 degs. Cent.) by the action of the current, and about one-half of the energy of the electricity is required for this purpose, the other half performing the actual electrolytic dissociation of alumina into the metal and oxygen. Alumina is added to the "pots" at regular intervals as that dissolved in the electrolyte is decomposed, and the surface of the electrolyte is kept covered with powdered coke to prevent loss of heat by radiation."

No similar description of the Heroult process as worked at Neuhausen or at Foyers is available, but that given in the original patent specification may be quoted here:

> In this specification an iron vessel thickly lined with carbon blocks was described, and the walls of this were used as the negative electrode exactly as in the Hall process. A bundle of carbon rods or plates was suspended over this vessel, and functioned as the positive electrode of the electrical circuit, and the electrolyte was composed of fused alumina without any other admixture. Molten copper was, however, used on the floor of the bath, and the aluminum, separated from the oxide by the action of the current, at once united with this and formed aluminum bronze. The electrolyte was kept in the molten state by the action of the current, and external heating does not appear to have been used at any stage in the development of the Heroult process. The modifications introduced into the Heroult process since 1889 relate to the composition of the electrolyte, and as now carried out at Neuhausen, La Praz, Foyers and elsewhere, it is practically identical in principle and operation with the Hall process.

The only modifications in the process in recent years have been in the methods of preparing the pure alumina—the raw material of the process—from Bauxite, the mineral containing it. It has been found that the degree of purity of the metal separated in the

bath, is largely dependent upon the absence of the impurities, silica, iron, etc., etc., in the alumina and carbon employed. Much more care therefore is now given to this part of the manufacture. Attempts have also been made in Ameria to cheapen production by submitting the bauxite to a preliminary treatment, which shall render the iron and silica it contains insoluble in the bath. It is not known whether these attempts have been successful.

The cost of producing the metal is very largely dependent upon the cheapness of the supply of raw materials and of electric power, and the companies engaged in this industry control in nearly every case their own supplies of Bauxite and have developed their own water power.

ALUMINUM WORKS AT LA PRAG, FRANCE.

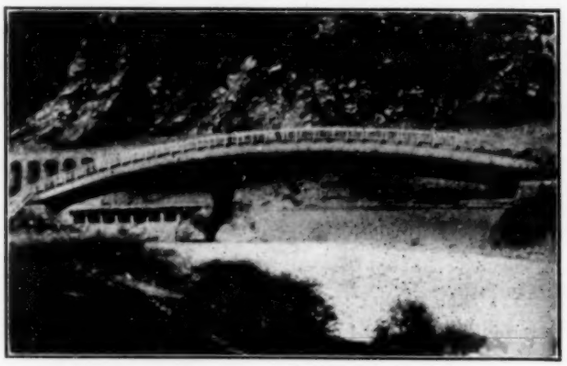
At the present date there are five old-established companies (controlling 13 works) engaged in the manufacture in Europe and America, with two or three newly formed companies in a state of suspended animation, due to the collapse of prices which marked the years 1907-1908. The output of these 13 works amounts in the aggregate to between 25,000 and 30,000 tons per annum—a total which would be greatly increased if the price of the metal would rise to a more remunerative level. The controlling patents of the process have now lapsed, in all European countries, and in America; but so far the new companies which have taken up the manufacture of aluminum, have met with little financial success. The following table gives the estimated production and average price of the metal for the past ten years:

	Tons.	Price per lb. in pence.		Tons.	Price per lb. in pence.
1900	7,192	16.00	1905	9,000	16.06
1901	7,420	16.00	1906	12,000	21.42
1902	7,750	12.85	1907	19,000	17.88
1903	8,102	12.85	1908	25,000	10.39
1904	8,550	12.85	1909	25,000	6.95

The most favorable estimate of the bare operating cost of producing the metal is £61 per ton (6.52d. per pound, 13.04 cents), and it will be seen that there is little margin for profit on the manufacture, at the prices ruling in the aluminum market at the present time. The collapse of the combination of European aluminum manufacturers which regulated the production and price in Europe down to September 1908, was brought about by the lapsing of the patent rights, and by the erection of many new works for the production of the metal.

The price obtained for the aluminum and the profits made by the older companies in the boom year 1906, were largely the cause of this increase of productive power, since the eyes of the capitalists and company promoters were attracted by the possibilities of the light metal. Several of the companies promoted in that year have gone into liquidation—and the old-established British Aluminum Company, with works at Foyers and Kinlochleven in Scotland, and at Stangfiord in Norway, has been crippled by the collapse in price.

However, ups and downs of this character always occur in the history of new industries, and aluminum has already established its place as a useful metal, in the arts and industries. Its production by the electrolytic process will therefore continue to be carried out upon a larger and larger scale of operations—and possibly before the end of the twentieth century, it will have taken largely the place of copper in the world of industry.



THE PIPE LINE OVER THE RIVER AT LA PRAG, FRANCE.

COPPER

History does not record who was the first metallurgist to employ electrolysis for the separation of pure metallic copper from an aqueous solution of its salts, but it is known that in 1839 an electric current had been employed for copying moulds and casts in copper, and that Jacobi, Murray and Spencer in that year, laid the foundations of the modern methods of preparing electrotypes. Twelve years later—Charles Watt in his remarkable Patent Specification, No. 13,755, suggested the use of the electric current for refining crude copper, and between the years 1865 and 1869, James Elkington of the famous Birmingham firm of electroplaters carried Watt's ideas into practice, by planning and starting the first electrolytic copper refinery at Pembrey in South Wales.

The copper refining process, which was started by Elkington upon a very modest scale at Pembrey—41 years ago—has now grown into the largest and most important of the electro-metallurgical industries, and over one-half of the annual output of copper by all the mines of the world, is now submitted to the electrolytic refining process before it is placed upon the market. The scale and magnitude of the refineries where this electrolytic separation is carried out, have been enormously increased, during the intervening period of growth, and the Pembrey Refinery with its output of 250 tons of copper per annum, has given place to refineries which have an annual production of 120,000 tons.

The electrolytic process itself is simple, and the chief difficulties in its development have been those of a mechanical and engineering character.

(To be continued.)

METALLURGY FOR GOLDSMITHS AND JEWELERS.

AN ARTICLE GIVING A DETAILED DESCRIPTION OF THE METHODS PURSUED IN ENGLAND IN THE PREPARATION OF ALLOYS OF THE PRECIOUS METALS.

BY "ARGENTUM."

Metallurgy has been defined as "The art of contracting metals from their ores and adapting them for use," and, as the materials used in the manufacture of jewelry are often of a complex character, some considerable knowledge of the latter portion of the subject is needed in order to obtain products adapted to the particular requirements of each special branch of the business. Further, there has been so large an increase in the number of alloys used that a correspondingly greater acquaintance with such matters is requisite than was formerly the case. The jeweler of the old days was content with about three or four qualities of gold, articles being made of "bright" or of "colored" gold, with a somewhat higher quality between 15 and 18 carat for Alberts, etc., and 22 carat for wedding rings. Of these the quality was not often exactly known, "bright" gold being of any quality up to 9 carat, "colored" from 12 to 14 carat, and, as articles were rarely hall-marked, exact quality was not essential.

As a contrast with this simple list, the worker of the present day has a choice of ten or eleven qualities, of which five may be hall-marked, and of a number of different alloys in each of these qualities. Another great difference between the practice of former times and that of the present is found in the transference of the preparation of alloys of gold from the jeweler to the bullion dealer, who sells the gold ready for use. The jeweler of the old days prepared his own alloys, melted them himself, rolled them out into sheet or drew them into wire as was requisite, in fact, he was a craftman not only in the use of his materials but in the preparation of them. Nowadays this is, to a very large extent, altered, for while many of the larger firms prepare their own gold, there is an apparently increasing number of small firms who never attempt anything of that nature, in fact, some of them do not even possess a plate for wire-drawing. Rolling into sheet is usually done by a rolling mill, and, as the plant is very costly, few jewelers could afford to have their own. The recent widely adopted plan of purchasing the gold, in just the size and shape required, from a bullion dealer has undoubtedly detracted, in some measure, from the jeweler's interest in his art, for the very fact of having himself prepared the material which he is building up into objects of beauty or of use must form a bond between maker and material, which will be conducive to the expenditure of greater effort and inventiveness upon it. Possibly there may be some commercial gain, especially to the smaller firms, in this system, as it enables them to purchase only such quantity as they require and so maintain only a small stock of unused material, but this is the only advantage, although one which particularly appeals to many makers.

In considering the metallurgy of the materials used in jewelry, the various metals must be studied individually as well as in combination, while the variations in practice of different "schools" of manufacturers are of interest. For instance, there is a division of opinion as to whether the best results are obtained by the use, for making alloys of gold, of "fine" (pure) gold, 22-carat gold (sovereigns), or the gold obtained by melting metal of high quality in such manner as to remove practically all the base metal. Each of these materials has its strenuous advocates, men often of large and varied experience, who act upon their own convictions with apparent success. It is, perhaps, not obvious in what manner any compounds can be better than pure gold as a starting point, and it is difficult to perceive what beneficial properties can be conferred by the operation of alloying the gold and melting the filings of this alloy, but jewelers will stoutly maintain that the gold, as prepared in the one particular way which they fancy, "works" better than any other.

THE PREPARATION OF VARIOUS FORMS OF GOLD.

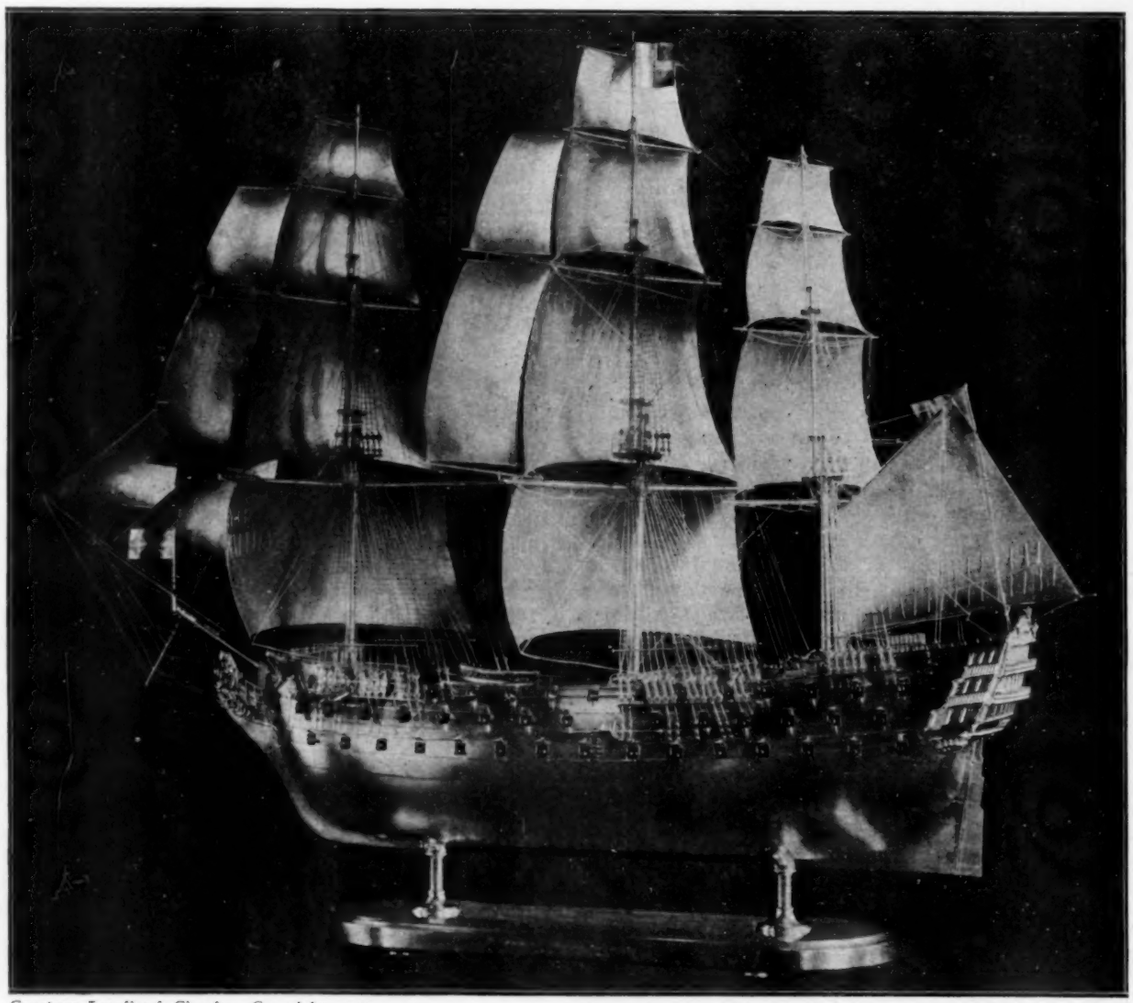
The material in most general use is fire gold, which is practically pure gold. This is prepared in four different forms, namely, "grain," "sheet," "brown" and "dull" golds. Of these the first is used for melting into gold of different qualities, "sheet" is used for gilding, while "brown," being easily dissolved, is in demand for the preparation of gold solutions. "Dull" gold is now very little used, but there are still a few jewelers who prefer this instead of "grain" for alloying. "Grain" gold is made by melting the brown powder obtained from refining, and slowly pouring it into water, and "sheet" gold is prepared by casting it into a bar and then rolling it out. "Brown" gold is the gold just left from the refining by the nitric acid process, washed and dried, and "dull" gold is made by heating this to a red heat, when it changes color and becomes yellow.

The actual process of refining gold is not of special importance, perhaps, to the jeweler, but it is interesting on account of its great antiquity. The early Jewish writers refer to gold "refined by fire," and this still constitutes one stage of the operation. The ancients, however, only carried the refining process as far as the removal of the base metal, and their refined gold contained at least part of the silver which is, almost invariably, associated with gold in nature, so that gold "refined by fire" was generally alloy of gold and silver, very soft, but varying in color according to the proportion of silver present. Similar gold is to be found in many of the articles of jewelry made by native craftsmen in eastern countries, especially in the older examples of such work, and the quality of the gold may be as low as 15 or 16 carat, or as high as practically pure gold.

With the fine gold, of whichever kind, must be mixed various other metals to reduce the quality, silver and copper being the two metals most largely used. In the higher grades of gold, down to 9 carat, little else is used except for very special purposes, but for 9 carat and lower qualities, smaller or larger proportions of other metals are introduced, according to the special properties required. Of these other metals zinc (or spelter as it is often termed) is the only one in common use, although cadmium, etc., are occasionally added in making solder. In these lower qualities there are more varieties, giving a wider range in color, malleability, ductility, etc., while the presence of very small quantities of impurities, such as arsenic, etc., may in some measure affect the physical properties above mentioned.

The silver used is, as a rule, in the form of grain silver, which is commercially pure, while the copper is mainly of the variety known as "Swedish" copper, sup-

plied in coils of wire weighing 1 lb. It is not at all satisfactory to metallurgists that so much of this foreign copper is imported, but efforts to obtain a similar material of British manufacture have only resulted in failure. The continental smelters appear to "finish"' the wire better, sending it out in very neat, compact coils, and an attempt to introduce British wire some years ago failed, apparently because of the a constituent of a gold alloy, is usually added in the form of "composition," which is a mixture of copper and zinc, and here a curious fact may be noticed, for although the jeweler would, in most cases, decline to use any copper other than "Swedish" or electrolytic, yet much of the "composition"' is made from ordinary bar copper, and this apparently without any deleterious effect. "Composition" is made in two shades of color,



Courtesy Jewellers' Circular. Copyright 1910.

A FAITHFUL MODEL OF THE "VICTORY" IN THE KAISER'S SILVER FLOTILLA.

One of the foremost members of the famous miniature silver fleet of the German Emperor is the exact reproduction, shown above, of the famous flagship of the British Admiral Nelson, the "Victory," which still rides at anchor in the bay of Portsmouth. On this vessel the great sailor met a victorious death at the battle of Trafalgar on Oct. 21, 1805. The model, the hull of which measures 1¼ yards, was presented to the Kaiser on the occasion of his silver wedding in 1906, having been executed by M. H. Wilkens & Söhne, Hermelingen.

The whole silver flotilla of the Kaiser, which he treasures very highly, was exhibited by him at the Shipbuilding Exhibition held in Berlin in 1908. The collection includes models of various ships, yachts and prize trophies. The ship models represent certain sailing types of the past.

There is also a Chinese war junk, a gift from Prince Henry, as well as a life-saving boat, equipped in regulation style, from the Deutsche See Berufsgenossenschaft, in the collection.

The schoolship "Grossherzogin Elizabeth" represents the modern type of sailing ships of the 20th century. Four other models show the sailing yachts "Welle," "Komet," "Iduna" and "Meteor."

lack of these smart, outward appearances, for the jewelers could not be persuaded that it was as good as the "Swedish" wire.

Some jewelers prefer electrolytic copper for alloying purposes, and it has been stated that the very best results are obtained by the use of this copper after being melted and drawn into wire. Zinc, when needed as known as "yellow" and "red" composition, respectively, the color depending upon the relative proportions of the two metals. By the addition of one or the other of these, together with varying proportions of silver and copper, a great variety of alloys of gold are obtainable, differing widely in color, hardness, etc. It would be interesting and instructive if some sys-

tematic examination of these various alloys could be made, both chemically and microscopically, in fact there is ample scope for much useful research work in connection with alloys of gold.

Metallography would doubtless prove the presence of certain definite alloys, containing two, three, or four metals, in the mass, and might give some indication of the compounds which most affect the physical properties, so that possibly, in the end, the jeweler might be given some data upon which to proceed when trying to make a gold alloy possessed of some particular physical property, some limits or relative proportions of certain constituents which would enable him to avoid part of the waste of time, labor, etc., which often attends his experimental work. Such an investigation would, necessarily, be a matter requiring much time and money, and could only be attempted by an institution of the nature of an university, school of mines or technical school, while even such would very possibly hesitate before embarking, on any large scale, on such a costly undertaking. Having now noticed the different metals which are in common use for the making of gold alloys of different qualities, the proportions adopted and the methods employed may be next considered.

QUALITIES OF GOLD ALLOYS.

The quality of a gold alloy is expressed in carats and grains, there being 4 grains to a carat. Pure gold is of 24-carat quality, and the terms 22-carat, 18-carat, etc., indicate the proportion of pure gold in 24 parts of the gold alloy.

22 CARAT.

The highest quality of gold which is made into jewelry in this country is 22-carat. This contains 22 parts of pure gold to 2 parts of alloy, and is known as "standard" gold. The published market price of gold is that of this quality, and assays of bars of gold are reported as "better" or "worse" than standard. Our gold coins are made of 22-carat gold, but practically the only articles of jewelry of this quality are wedding rings. The gold is alloyed with copper and silver, usually about 3 parts of copper to 1 of silver, and the resulting alloy is a soft, ductile metal, easily worked up into rings. Formerly a few watch cases were made of 22-carat, but such articles are now rarely manufactured.

18 CARAT.

This is the next quality in common use, and is adapted for the making of a variety of goods, such as chains, rings, brooches, etc. It is composed of 18 parts of gold with 6 of alloy. The alloy is either silver or copper, or a mixture of the two. Sometimes the alloy is only silver, especially for medals, or to make "green" gold for ornamenting brooches, etc. A very general custom is to use equal parts of silver and copper for the alloy, this producing a gold of medium color and one which is suitable for almost any class of work. For gem setting this is a very good alloy, as the formation of the "grains" for setting is more easily effected and the grains are tough, so do not break off. In some cases a larger proportion of copper is used, giving a red 18-carat, but this alloy is somewhat harder and less ductile than the other, while an excess of silver makes a softer alloy of a paler color.

15 CARAT.

In this quality, similar gradations of color to those in 18 carat are obtainable, but if silver only is used for the alloy, the result is a green gold much paler in color than the 18 carat green, while if both silver and copper are included, the gold produced is not of such a rich color as is that of the higher quality, and is, generally speaking, somewhat harder and less ductile. Between the green 15 carat and the ordinary color there are alloys suitable for pearl-setting and similar purposes. These contain a little copper, about 2½ per cent. to 3 three per cent. of the total weight being copper in the softer golds. A proportion of copper, about 15 to 18 per cent., makes a yellow gold which approximates more nearly to 18 carat in color, but is rather hard. 15 carat gold is more durable in wear than 18 carat, and as it "colors very well," it is largely employed in the manufacture of brooches, bracelets, etc., in addition to its use for chains of various kinds.

(To be continued.)

DURALUMIN, A NEW LIGHT ALLOY.

By reason of the demands of builders of flying machines and dirigible balloons there have been made, recently, many experiments in the line of light and tough alloys; and among the results of these experiments is one series to which has been given the name of "duralumin"; the invention of Herr A. Wilm, of Schlachtensee, near Berlin. Among the alloys in the series to which this name has been given is one containing 90 to 95 per cent. of aluminum, and which has about the same properties as good Bessemer steel, except that its specific gravity is only about 2.8; that is, only about one-third so great as that of iron and brass.

This metal has great value not only for the so-called "aviators," but also for the manufacturer of materials of war. As its name would indicate, it possesses great hardness, even when annealed; and cold working increases this quality. In determining the hardness, there was employed the Brinell test, by means of a hard steel ball; according to this the hardness of pure aluminum is 40, and that of the softest duralumin 98. The hardest of the series reaches in its natural state 125, which may be increased by cold hammering to 174. Further experiments proved that cartridge shells, when annealed, showed 60 degs. of hardness, but when rolled, 190 to 200. For cartridges there is required a hardness of 160 at the base, to prevent the latter expanding with the blow of firing; but the powder chamber must be elastic in order to offer no resistance to withdrawal; and the walls must have a certain amount of stretch, otherwise they would tear off in the barrel. In order to attain these qualities there must be used one of the hardest duralumin alloys, starting at 120; here, however, running up against the difficulty that a natural hard alloy is not so easy to work—especially cold—as a natural soft one. But with this alloy one can start with a high degree of hardness and by treating the metal hot can reduce this so as to lighten the operations to which it must submit.

For airships and the like, the stretch under extension must not be over 8 per cent, as at this point the limit of elasticity is not very certain. But as a rule, when one has to choose between a material with 20 per cent. extension and one of only 10 per cent., when in the first case the textile strength is 21 kg. per square millimeter—30,000 lbs. per square inch, and in the second 39 kg.—55,700 lbs., one decides in favor of the latter. Tests show that the new alloy breaks at 62 kg. per square millimeter, 88,000 lbs. per square inch. The English government has tested the metal's resistance to sea water, and for one of its vessels that is being built by Vickers, Sons & Maxim, has ordered six gross tons thereof.—Robert Grimshaw.

THE CONSTITUTION OF THE BRASS ALLOYS.*

By O. F. Hudson, A.R.C.S., M.Sc.

The alloys which are grouped under the general title of brass are composed of copper and zinc, together with, as a rule, small quantities of other metals, and they constitute the most important series of non-ferrous alloys. Varying widely in composition and properties, the brasses include a large number of more or less well recognized alloys suitable for particular purposes, to which special names are given, such as common brass, yellow metal, Delta metal, etc.; but until recently very little was known of either constitution or the relations which existed between the component metals in them.

The metals or other elements present in any alloy may exist in three conditions, namely:—

(1) In the pure, or practically pure, state.

(2) In the form of a solid solution.

(3) As a chemical compound, which also may be dissolved in a solid solution.

In the alloys dealt with here the only element that is found in a state of comparative purity is lead, and no part of any brass or bronze can be separated or distinguished as copper or zinc or tin, etc. By far the most usual condition in which the metals exist in the useful copper alloys, or in any alloy, is as a solid solution. A solid solution in that the solvent and dissolved substances are capable of forming perfectly uniform mixtures in more or less widely varying proportions from which the component substances cannot be separated by mechanical means. The metals entering into a solid solution cannot be recognized as such, each of the metals losing its distinguishing characteristics, which are merged in those of the solution. Unlike liquid solutions, solid solutions are usually, and in the case of metallic solid solutions always, crystalline.** Again, in a liquid solution diffusion is rapid, and whatever the concentration, the solution is readily obtained uniform throughout. On the other hand, diffusion takes place comparatively slowly in solids, and it is for this reason that metallic solid solutions, when in the cast condition, frequently show, when examined under the microscope after polishing and etching, a core or skeleton of a dark etching material in each crystal. When a solid solution is produced by solidification from a molten alloy the solid that separates first has neither the same composition as the liquid from which it solidifies nor of the solid that is deposited after; and, as diffusion is slow in a solid and between the solid and any remaining liquid, it often happens that each crystal of the solid solution is not quite uniform in composition when the alloy is cold. Annealing, especially after rolling or otherwise working the alloy, gives crystals that are perfectly uniform in composition.

Many metals are capable of combining with each other, as well as with non-metals, to form true chemical compounds, but these compounds are generally hard and brittle, and except in special cases, *e.g.*, bearing metals, their presence in an alloy is not usually desirable. It is difficult in many cases to obtain inter-metallic compounds in a state of purity, and they are commonly more or less soluble in one or both of their components. If an inter-metallic compound is capable of being heated to its melting point without decomposition, it has, like a pure metal, a definite melting and freezing point, which is usually higher than either of its component metals.***

All alloys thus consist of either a solid solution, a compound, or mixtures of solid solutions and compounds, and rarely contain a pure metal. In any series of alloys of only two metals there can never exist together under normal conditions, *i.e.*, in a state of equilibrium, more than three separate and distinct substances, and then only at a definite temperature in an alloy of definite composition, as in the case of the freezing or melting of a eutectic. Except in such or similar cases a binary alloy never contains more than two definite and distinct substances. A eutectic is an intimate mixture of two solid substances which constitute the most fusible alloy of the series, and at its freezing point the molten alloy (a liquid solution) co-exists with the two solid substances which form the eutectic. Thus is a eutectic has a fixed and definite melting point, and is always regarded as a separate constituent of an alloy. It must be remembered, however, that it is not a single substance, but a mixture of two. Partly owing to the fact that it has a lower melting point than the rest of the alloy, a eutectic is often a source of weakness and brittleness, and is not a common constituent of the mechanically useful alloys. When an alloy contains more than two metals the number of different substances which can co-exist in it in a state of equilibrium becomes larger, the maximum being one more than the number of the compotent metals. The constitution of series of alloys of three or more metals is thus usually very complex, and it has been studied as yet in only a few cases.

CHANGES THAT OCCUR AFTER SOLIDIFICATION.

In addition to the changes that occur during solidification, other and important changes frequently occur in alloys after they are completely solid, leading to the formation of entirely new substances, and as will be seen later, such changes occur in many of the useful brass alloys. Previous reference has been made to the slowness of diffusion in solid alloys, and other changes in the solid are often equally sluggish. In deciding, therefore, on what is the normal constitution of any alloy at any temperature, it is necessary to make sure that all changes that may occur in the alloy at that temperature have been completed, or, in other words, that the alloy is in a state of equilibrium. The constitution of most of the important series of binary alloys has now been more or less completely worked out, and equilibrium diagrams of each of these series, in which the substances or phases that the equilibrium in ony alloy at any temperature, have been published. The constitution of the copper-zinc series of alloys was first satisfactorily explained by Shepherd† in 1904, and his results have been checked by others since, notably Tafel,‡ with the result that Shepherd's equilibrium diagram has been proved to be correct in the main, and so far, at least, as the useful or yellow alloys are concerned, very accurately represents their constitution.

In alloys of copper and zinc which contain less than 70 per cent. of copper, the influence of another substance besides the α solution must be considered. This is known as β, and is also a solid solution of zinc and copper, which at the ordinary temperature may contain

*From a paper read at the British Foundrymen's Association annual convention, Manchester, England, August 2, 3 and 4, 1910.

**It may be noted that certain liquids, as in the case of some organic compounds, are capable of assuming crystalline forms to which the name "liquid crystals" has been given.

***For this and other theoretical portions of this subject reference should be made to works such as Dr. Desch's "Metallography," Longmans, 1910, in the series of Text Books of Physical Chemistry, edited by Sir William Ramsay.

†Journal of Physical Chemistry, 1904, 421.

‡Metallurgie, 1908, 5, 343.

between 51 and 53.5 per cent. of copper, but at the melting point may contain anything between 46 and 70 per cent. of copper. The β solid solution of copper and zinc is somewhat harder, and, when cold, much less malleable and ductile than the α solid solution, but it is fairly malleable when hot. The β solution, when examined microscopically, shows no cores in the crystals due to want of uniformity in composition, and rolling, hammering, etc., does not cause the crystals to become entwined. The properties of the β solution are thus quite distinct from those of the α solution. A brass containing between 70 and 64 per cent. of copper consists of α, together with some β, but this β is redissolved in the α at lower temperatures. The solution of the β in the α is a change that takes place somewhat slowly, and when cast these alloys always retain some of the β enmeshed in the α and accentuating the dendritic structure of the latter. Annealing, especially after rolling, enables the α completely to dissolve the β, and the structure and constitution of these alloys is then exactly the same as those with higher percentages of copper. The α solid solution of zinc (and similar solid solutions of other metals) in copper is strong, malleable, and ductile, and is specially suitable for rolling and drawing cold.

When the amount of copper is between 63 and 64 per cent. the alloy consists of a mixture of the two substances α and β under all conditions. The only change produced by varying the rate of cooling or by annealing is a difference in the relative amounts of α and β present. The α solution is capable of holding more zinc in solution at low temperatures than at high, while the β is not able to retain so much zinc in solution at low temperatures. Consequently, if equilibrium is maintained at all temperatures, the quantity of α present will increase, and the quantity of β decrease as the temperature falls.

Alloys containing between about 45 and 63 per cent. of zinc consist only of the β solid solution when just solid. Of these alloys only those containing 51 to 53.5 per cent. of copper preserve this constitution at all temperatures. When the copper is between 53.5 and 64 per cent., the β solution that crystallizes from the molten alloy deposits crystals of α as the temperature falls, and hence, under normal conditions, these alloys consist of a mixture of α and β. This mixture of α and β is the constitution of alloys of the Muntz metal class, which are particularly suitable for hot rolling, the β solution being far more malleable when hot than when cold.

The two solutions, α and β, are easily recognized under the microscope, as one or other of them (usually β) becomes stained or darkened by the etching agent before the other is affected, or, if the etching process is carried out so as to leave the entire surface clean and free from stain, then a marked difference in color (α reddish-yellow, β greenish-yellow) serves as a distinguishing characteristic. The micro-structure shows a mixture of α and β arranged in more or less distinct areas or grains, which represent the original crystals of β. On rolling the α and β crystals become broken up and intermingled, and subsequent annealing causes a regrowth of crystals, the α and β becoming more uniformly mixed and without any trace of the original large crystal grains. The best alloys of this class contain an excess of α, and those with an excess of β have, if the alloys are of copper and zinc only, inferior mechanical properties. Brasses consisting of an excess of β, or even of β only, are, however, widely used in the form of special brasses, such as Delta metal, sterro metal, manganese-bronze, etc. In such cases the addition of small percentages of other metals, such as iron, manganese, etc., seems to modify the β, giving it much increased strength and toughness.

When an alloy of zinc and copper contains less than 51 per cent. of copper, the originally formed β deposits, as the temperature falls, crystals of another substance, possibly an intermetallic compound, known as γ, which is hard, white and brittle. Some of this exceedingly brittle γ separates between the β crystals, and the whole alloy is brittle and useless, except as a solder.

EFFECT OF OTHER METALS.

The general constitution of the yellow copper-zinc alloys has thus been outlined, and it now remains to consider the effect of other metals which may be present, whether added intentionally or present in the form of impurities. Of these metals the commonest are tin, lead, and iron. Tin, to the extent of about 1 per cent., seems to be dissolved in the brass, both α and β. But when present in excess of this amount it gives rise to a separate constituent, which is seen under the microscope as a light-blue material. This constituent is hard and brittle, and probably is a compound of tin and copper of the formula Cu_4Sn. Tin up to about 1 per cent. increases the hardness of brass without impairing to any extent its malleability, while at the same time it makes the alloy better able to resist corrosion under certain conditions. One of the best known alloys of this class is the Naval brass, containing 60 to 62 per cent. of copper and 1 per cent. of tin.

Lead, which is almost always present in brass, is not held in a state of solution or combination in the solid alloy, but is present in the free condition. It is therefore usually recognized readily when the brass is examined microscopically, being seen as small round particles or streaks. Owing to its very low melting point, the lead remains fluid long after the rest of the alloy is solid, and so it tends to form a film or layer round the brass crystals. Except in very small amounts lead thus impairs the strength and malleability of brass, but most brass contains 0.1 or 0.2 per cent. of lead, which is introduced as an impurity in the spelter. This small amount of lead does not seriously injure the mechanical properties of the brass, and common brass for castings may safely have more than this amount. Although much lead lowers the strength and ductibility of brass, it serves a very useful purpose in some alloys, as it very much improves the turning qualities, and brass containing about 60 per cent. of copper (usually a little less) and about 2 per cent. of lead is largely manufactured as "turning metal." With more than 2 per cent. of lead the metal is inferior, and difficult to roll.

The use of iron and manganese in brass has already been referred to. This class of alloys includes Delta metal, sterro metal, Durana metal, manganese-bronze, and many other similar alloys with special trade names. They usually contain between 55 and 60 per cent. of copper, with 1 or 2 per cent. of iron, and sometimes small amounts of manganese and aluminum. The iron, aluminum, and manganese enter into solution, and the alloys consist of α and β, in which the β predominates, or even of practically nothing but β. Brasses of this character have often exceptional strength and toughness, as well as resistance to corrosion, and are being increasingly used.*

*Very full information on the constitution, structure and composition of the brass alloys is given in "Alloys," by E. F. Law. Griffin, 1909.

In addition to the metallic or other impurities or additions, brass usually contains some mechanically intermingled substances, such as zinc oxide, which, if present in unusual amounts, may have a harmful effect on the properties of the alloy, causing weakness and sponginess. The presence of dissolved gases in the molten alloys may also have a very injurious effect on their properties, since if liberated during the process of solidification, they cause sponginess and intercrystalline weakness. Any exact knowledge of the behavior of such impurities as oxide and gases in brass alloys is very limited, and the probable importance of their influence is not always realized.

In concluding this paper a classification of the useful brass alloys, according to their composition and the purposes for which they are used, may be given.

(1) α *Brasses.*—Alloys consisting of the α solid solution only. They include the most ductile brasses, such as the 70.30 alloy.

(2) α β *Brasses.*—Alloys consisting of about equal quantities of the solid solutions α and β, or those in which the α predominates. These brasses are suitable for hot rolling, and include such alloys as Muntz metal. Special alloys containing tin or lead, such as Naval brass and turning metal, belong to this class.

(3) β *Brasses.*—Alloys consisting of β only, or mixtures of α and β, in which the β predominates. These alloys almost always contain small percentages of iron, manganese, or other metals, and include special brasses, such as Delta metal.

THE PRACTICAL LIMITS OF ACCURACY IN CHEMICAL ANALYSIS.

By Ernest A. Lewis*

It is now usual for the brass and copper trade to make use of the services of the analyst to a greater extent than formerly. There is still a certain prejudice against analysis, which is to some extent justifiable. Chemistry being comparatively modern as regards its application to the brass trade, properly trained and experienced analysts are comparatively scarce. The average student after going through his college course is quite at sea when asked to analyze a mixed sample of brass borings containing various qualities and sizes sometimes adulterated with sand. The object of this article is not to show how to analyze, but how to use the results obtained.

ERNEST A. LEWIS

In buying a large parcel of brass borings, a sample of 2 or 3 pounds is submitted to the prospective buyer, and he passes it on to his chemist (if he employs one) for the copper assay and the oil, or moisture as it is technically termed. This is not sufficient unless the parcel is very even in quality. It is well known that thin brass borings and fine powder lose more spelter in melting than thick ones. The whole sample should be weighed and dried over a burner, the oil driven off and, of course, determined by the loss in weight. The sample is then sieved through a sieve of ⅛-in. mesh and the portion going through weighed and reserved, the remainder is sieved through a ¼-in. mesh, and if any does not go through it is weighed, thus we have three different particulars; the proportion of fine metallics, metallics and rough metallics.

The analysis is made on a 10 or 20-gram lot weighed in the proper proportions of each. In some cases it might be an advantage to estimate the copper in each of these. It is evident that this method would give more accurate results in the case of rough mixed borings than the ordinary methods of weighing 10 or 20 grams at random, and, in addition, we have valuable information as to the probable loss on melting. An ordinary analysis may show a parcel to contain 63 per cent. copper, but the proportion of fine metallics may be so great that it is not worth more than a 60 per cent. basis. If a hundredweight of the parcel is available it can be weighed and melted down, the loss in weight calculated and the resulting ingots analyzed.

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When reading the results of an analysis it must be borne in mind that the actual figures given are only approximations, the greater the skill of the analyst, the nearer the correct result. Some time ago I saw a copper analysis which the analyst had reported to the sixth place of decimals, it was a wonderful collection of figures, the percentage of copper was given by the difference, and it showed no oxygen. This was a refined ingot copper. Reports to the third and fourth place of decimals are often given, but no competent analyst would think of writing such a report.

SOME LIMITS OF ACCURACY.

The only metal it is possible (with the exception of gold and silver) to estimate within .001 per cent. in copper is bismuth by the color test. Of the various constituents in copper or its alloys, there is the metal itself. If the assay of refined copper is made on 2½ grams by the electrolytic method, it may be accurate within .02 per cent., but using only .7 gram an error of 1 milligram means .14 per cent., while an error of .5 milligram means .07 per cent., and it is a skilful analyst who can work within .0005 gram on .7 gram. What is the use of reporting a copper analysis past the second decimal place? Such reports are misleading.

The estimation of copper in brass is relatively more accurate by the electrolytic assay than in copper alone, as larger quantities are taken to get .7 gram of deposited copper and the experimental error is correspondingly reduced. Tin, in small quantity up to .1 per cent., can be estimated accurately within .01 per cent., and in naval brass containing about 1 per cent. tin, the assay would be accurate within .05 per cent. In gun metal containing 10 per cent. tin, if it is correct within .2 per cent. the analyst has to be very careful, an accuracy of .5 per cent. is more usual. Tin in white metal containing large percentages of tin is rarely accurate nearer than 1 per cent. by direct analysis. Errors of 2 or 3 per cent., and even more, are not uncommon in assays of the same metal sent to different analysts. Such big mistakes are mainly due to careless work.

Antimony in copper can be estimated fairly accurately within .01 per cent., in gun metal containing about 1 per cent. antimony within .1 per cent., in white

metal containing 10 per cent. antimony and upwards it cannot be expected more accurate than within .5 per cent., the methods of analysis are not accurate nearer than this. Arsenic in copper can be estimated accurately by distillation within .01 per cent. Lead in copper can be estimated within .01 per cent., in brasses containing up to 2 per cent., an accuracy of .05 per cent. only is obtainable, in the bronzes containing 10 to 30 per cent. lead the accuracy of the assay is within 0.5 per cent. white metals consisting of lead as a basis can only be expected to be accurate within 1 per cent. when working on filings obtained by melting down drillings from the bulk. An analyst might report a certain parcel of white metal as containing 80 per cent. lead, another might report the identical sample as 79.5 per cent. lead and still another 80.5 per cent. By working with atomic weight accuracy, it is possible to get results much nearer the truth, but the time the analysis would take would nullify the value of the analysis.

Sulphur can be accurately estimated in copper, provided an accurate method of assay is used and care taken not to introduce sulphur in the reagents used. Phosphorus can be accurately determined in copper, in phosphor bronze an accuracy of .02 per cent. can be obtained, but in phosphor copper containing 10 to 15 per cent. phosphorus, an accuracy of .5 per cent. is all that can be obtained. Iron in copper and brass, free from tin, can be accurately determined, but in gun metal, unless special methods are used to determine what comes down with the tin, the iron may be 25 to 50 per cent. below the truth. The separation of the iron is thus complicated and it is not to be expected to get a gun metal with .2 per cent. iron nearer than .02 per cent.

Aluminum is a very difficult metal to determine accurately, an error of .5 per cent. on a 10 per cent. aluminum bronze is within the bounds of possibility. The determination of aluminum in aluminum zinc alloys is exceedingly difficult, and if it is determined directly within 1 per cent. it is not a case of an inaccurate analyst, but an inaccurate method. Fortunately, the zinc and copper can be accurately determined and the aluminum is best taken by difference.

The determination of zinc in ordinary brass can be accurately determined within .05 per cent., provided the copper is separated electrolytically. The hydrogen sulphide separation is of doubtful accuracy, even when the sulphide precipitate is redissolved and reprecipitated. Zinc in German silver can be determined as accurate as in brass, provided great care is used in separating the zinc sulphide, this precipitate being very fine.

Nickel in various alloys can be accurately determined by electrolysis, the chief source of error is loss during the complicated separation, the accuracy depends upon the skill of the analyst.

Manganese does not trouble the analyst in a copper works to a great extent, the published methods are very accurate.

ERRORS OF ANALYSIS

The errors of analysis may be divided into three classes:

1. Experimental error.
2. Error of method.
3. Sampling errors.

The first class of error is solely a personal one, as regards the second class a good analyst will get the best results possible with the known methods at his disposal. Methods of analysis are continually improving, but new methods are often published which are no more accurate than existing ones.

When I see an analysis reported past the second place of decimals I conclude that the analyst is either incompetent or is endeavoring to impress the non-scientific mind. A commercial analysis of gun metal or brass is quite sufficient for technical work if it can be relied upon to the first decimal place.

Many detailed methods of analysis have been published which, if carried out as described by their authors, could not be accurate. A chemist must avoid slovenly work and aim to get the highest accuracy possible within the limits of the method.

Sampling errors can be avoided to a great extent if reasonable care is used in taking the sample, but if a lead gun metal is just skimmed with a drill, an accurate analysis is impossible, drillings must be taken right through. It is the custom in some copper works when buying residuals to determine the moisture by heating in a pan and drying oil and organic matter off and then take a portion of the wet material, and instruct the chemist to assay it after drying at 100 degs. Cent. This is absolutely wrong and unfair to the seller, such samples may be as much as 3 per cent. below the truth in copper contents. The only way to get a fair sample is to dry 2 lbs. or 4 lbs. and send portions of the dry sample for assay. This method ensures fairness to both buyer and seller.

WORLD METAL PRODUCTION.

[From the United States Consul-General Richard Guenther, of Frankfort.]

From the annual reports of three German joint stock metallurgical companies, with head offices here, the following translation has been made of certain statistics on the non-ferrous metal production and consumption of the world for the year of 1909.

The world production of copper in 1909 aggregated 844,100 tons (metric ton = 2,204.6 lbs.), which exceeds by about 100,000 tons that of the year before. The United States had the largest share, 498,200 tons, an increase of about 16 per cent. over the output in 1908. The world consumption of copper in 1909 reached 782,800 tons, exceeding that of the preceding year by 85,100 tons. The giant share in the consumption fell to the United States, and amounted to 318,900 tons (against 208,800 tons in 1909); Germany consumed 179,100 tons; England, 109,100 tons; France, 73,100 tons.

The world production of lead last year aggregated 1,052,500 tons, divided thus: Europe, 505,800 tons; United States, 339,700 tons; Mexico, 118,000 tons; Australia, 77,200 tons. The United States consumed 365,200 tons of lead; Germany, 213,200 tons; Great Britain, 199,500 tons; France, 110,400 tons; Russia, 38,300 tons.

Of tin 108,300 tons were produced in 1909, of which 61,500 tons came from the Straits Settements ports; 35,600 tons from Bolivia; Germany produced (mainly from Bolivian ores) 8,990 tons. The consumption of tin was distributed: United States, 42,800 tons; England, 17,500 tons; Germany, 17,100 tons; France, 8,750 tons; and Belgium, 1,300 tons.

The zinc production in 1909 was 783,200 tons, of which the United States contributed 240,446 tons; Germany, 220,100 tons, and Belgium, 167,100 tons.

In 1909 the world produced 16,100 tons of nickel, the chief contributors being United States, 9,000 tons; Germany, 3,100 tons, and England, 2,800 tons.

Of aluminum, 30,800 tons were produced and 24,200 tons consumed throughout the world, while the production of quicksilver amounted to 3,200 tons, of which Great Britain took 1,445 and Germany 723 tons.

THE CHEMICAL ANALYSIS OF SPELTER.

A Detailed Description of the Methods Employed for the Estimation of Common Impurities.

By Andrew M. Fairlie.*

The impurities most likely to occur in spelter are lead, iron and cadmium. The first two are present in all brands of spelter, and cadmium should always be suspected unless the spelter under examination is known to have been made from a cadmium-free ore. All three of the elements named enter into the composition of the majority of commercial zinc ores, and two other components frequently met with, namely, copper and sulphur, may also find their way into the metallic product. Tin has been found in some brands of American spelter, but it is probable that spelter containing this element has been made by some refiner of old metals, drosses, or galvanizing and tinning baths.

Spelter from such a source may contain still other impurities, but as it is not the purpose here to describe methods for the estimation of all of these, the reader interested in the uncommon impurities is referred to an excellent article on the determination of the impurities in zinc ores (*Engineering and Mining Journal,* Aug. 25, 1904, p. 298), by W. Geo. Waring. In addition to detailed instructions for the determination of lead, iron, cadmium, sulphur, copper, and lime in ores, valuable suggestions are given for the estimation of gold and silver, selenium, tellurium, thallium, indium, bismuth, manganese, cobalt and nickel. While the paper, as has been stated, treats expressly of the analysis of zinc ores, the methods given and suggested may be adapted to the analysis of spelter. Similarly, for the determination of arsenic and antimony, the reader is referred to the method of Skinner and Hawley (*Engineering and Mining Journal,* Aug. 2, 1902, p. 148).

In the present paper, the writer undertakes to describe briefly methods for the determination of only four constituents of spelter—zinc itself, and the three common impurities, lead, iron and cadmium. The methods given are published, not upon any claim to originality or novelty, but to render them more accessible to the readers of this journal, and to invite discussion with a view to the publication of better methods, if any are known and practised, or can be devised.

THE SAMPLE.

Commercial zinc or spelter ordinarily appears in our markets as rectangular grayish white slabs, about 18 inches long by 8 inches wide, and 1¼ inches thick, and the four edges are beveled inward from the upper or non-branded side. The slabs weigh about 50 pounds each. In unloading a car of spelter, at regular intervals a slab should be set aside to be drilled. For this purpose every tenth slab may be taken, or every twentieth, or every hundredth, according to the thoroughness with which it is proposed to sample the shipment. The drilling must be done, of course, without oil, and with clean drill and drill-press. The slabs of spelter should be wiped with a cloth if wet or dirty, and the drillings should not be handled with the fingers.

If only a few slabs are to be sampled, each slab should be drilled in several places, until a sufficient quantity of borings is obtained. If the number of slabs to be sampled is large, one hole bored through each slab would be sufficient, but the place for boring should be different for each slab, and should be chosen in a systematic way. If the borings are long and ribbon-like, they may be ground in a Hance mill, if one is at hand; otherwise they may be reduced in size by operating on them with a pair of shears or snips. In any case a magnet should be passed through the sample repeatedly to remove fragments of metallic iron from the drill or cutting tools.

SOME CHARACTERISTICS OF THE ANALYSIS OF METALS.

In general, the greater the percentage of any element in a substance submitted for analysis, the smaller the quantity needed by the chemist for the estimation of that element, and the more difficult it is to obtain results agreeing in the second decimal place. The converse of this is also true. The analyst of crude and refined metals deals on the one hand with percentages as high as 99.9 per cent. for the chief component of the sample, the estimation of which is made most accurately when working with a relatively small portion of the metal; and on the other with percentages of 0.01 per cent. or less for the impurities, and for these traces he needs large quantities of the substance to work with, in order to obtain an appreciable amount of the impurity sought.

Of the commercial metals, copper, thanks to the electrolytic assay, is susceptible of the most accurate estimation of its chief constituent, check assays agreeing within 0.01 of one per cent. The other extreme is exemplified by aluminum, of which a recent writer says†:

". . . We have for a long time renounced the idea of determining the proportion of the metal itself, owing to the great difficulty of estimating the latter with any approach to accuracy in samples containing as much as 99.5 per cent. . . . In most works it has become customary . . . to determine only those impurities present in appreciable quantities, and to call the balance aluminum . . ."

Spelter lies between these extremes. The percentage of zinc can be determined, both gravimetrically and volumetrically, to within 0.05 or 0.06 of one per cent., in spelter containing 99.7 per cent. and over, but only by chemists expert in the use of the methods. The novice need not condemn the methods because his first attempts at close results are ineffectual, for practice and familiarity will justify the claims made for their value. For accurate results, the necessity of a blank carried along with each assay must not be forgotten.

METHODS OF ANALYSIS. ZINC.

The analyst who has determinations of zinc to make cannot fail to profit by a careful study of an exhaustive article entitled "The Volumetric Determinations of Zinc," by W. Geo. Waring (Journal American Chemical Society, Vol. XXVI, 1904, pp. 4-29). For those to whom the original article is not accessible the following summary of Waring's method may be of service.

SOLUTIONS.

(1) Standard Potassium Ferrocyanide.—21.63 grams of Merck's pure potassium ferrocyanide and 7 grams of sodium sulphite crystals are dissolved in pure, non-aërated distilled water, the solution made up to exactly one liter, and thoroughly mixed. Theoretically, 21.544 grams of ferrocyanide is required per liter, but owing to impurities in the so-called "C.P." salt, it is found that from 21.55 to 21.80 grams is necessary. One c.c. of this solution should be equivalent to 0.005 gram of zinc.

*Copper Hill, Tenn.

†The Metal Industry, February, 1910.

(2) Uranium Acetate (Indicator).—Dissolve 4.4 grams of the pure salt (Merck's or Schuchardt's), in 100 c.c. of distilled water and 2 c.c. of acetic acid. If a pure acetate is not available, use the nitrate, 52 grams per liter.

STANDARDIZATION.

It is of primary importance in standardizing the ferrocyanide solution to obtain metallic zinc or zinc oxide which is absolutely pure. A high price does not insure purity, nor does the label "C.P." Some expensive forms of zinc sold by the chemical dealers have been found to be more impure than some brands of commercial spelter. The J. T. Baker Chemical Co. supply analyzed zinc metal called "C. P. Special," said to contain no arsenic or cadmium, .05% lead, and .014% iron. According to Waring, the stick zinc made by Merck and Schuchardt is almost absolutely pure when fresh, but soon acquires a coating of oxide which seriously diminishes its value. It is recommended that metallic zinc for standardizing be digested with ammonia and ammonium chloride, then washed thoroughly, first with water, then with pure alcohol and well dried. Keep in a glass-stoppered bottle.

Weigh accurately 0.3 gram of the pure zinc (or 0.37338 gram of the pure zinc oxide, freshly ignited) and dissolve in 25 c.c. of dilute hydrochloric acid (1:3), add 3 to 4 grams of pure ammonium chloride, and dilute to 200 c.c. with distilled water at about 60 degs. C. "Titrate at once with the ferrocyanide solution, running in about 58 c.c. at once with vigorous stirring. Note the change at this point in the appearance of the precipitate, a change from bluish white, thickish skim milk, to nearly pure white, accompanied by a thinning of the solution, and a separation of the $K_2Zn_3(FeCN_6)_2$ in flocculent form on standing for a minute, especially if the stirring has been vigorous. This appearance always occurs, at a temperature of about 60 degs., when the titration is within 2 or 3 c.c. of completion. Run in 2 c.c. more and the precipitate will lose its flocculent appearance, and will remain suspended for a considerable time. Test two or three drops of the solution by running them off the end of the stirring rod on to a drop of the uranium solution placed on a clean white porcelain plate. The solution must be *thoroughly* stirred each time and the rod and sides of the precipitating vessel be washed with a jet of hot water, after each addition of ferrocyanide, before testing. The test should give no tinge of brown or even the slightest flash of discoloration. Run in the ferrocyanide now drop by drop, testing after each addition, until a distinct, though faint flash of color is observed. When a definite reaction is obtained, allow the color to develop, which will require from two to three minutes before taking the final reading.

"Frequently it will be seen that, in addition to the drop which first gave the reaction, from one to five of the others develop a brown-red color. If this be the case, deduct from the burette-reading the fraction of a cubic centimeter corresponding to the number of drops that show a color, in order to obtain the correct reading. The dilution coefficient, *i. e.*, the amount of ferrocyanide necessary to give a reaction with uranium in a solution of the temperature and volume and containing the amounts of free acid and ammonium chloride that are in the solution being tested, at the end of the titration, is usually about 0.35 c.c., and must always be deducted from the burette-reading. The standardization should always be made in duplicate or triplicate." To find the value of 1 c.c. of the ferrocyanide solution, divide the number of milligrams of zinc weighed out by the corrected number of cubic centimeters required to complete the reaction.

THE ASSAY.

Weigh accurately 0.3 gram of the spelter borings, dissolve in 10 c.c. dilute nitric acid, cool, add 10 c.c. sulphuric acid, and evaporate to white fumes. Cool, dissolve soluble salts, and filter out the lead sulphate, washing with dilute (1:20) sulphuric acid. Boil the filtrate with a piece of metallic aluminum, to remove cadmium, and copper and bismuth if present, adding more sulphuric acid if the action with aluminum is not rapid enough. Add a drop of methyl orange to the filtrate from the cadmium, etc., and neutralize with a rather dilute solution of caustic soda, adding this reagent until the color of the indicator changes to light yellow, and then to a slight permanent cloudiness, due to the separation of hydroxides. Then add, drop by drop, enough 50 per cent. formic acid to barely restore the pink color permanently and add half a c.c. additional. Dilute to 200 c.c., and heat to 80 degs. C. From this solution the zinc is to be precipitated as sulphide by a special procedure, which Waring has described as follows:

"A rubber stopper, through which passes the delivery tube from a source of supply of hydrogen sulphide, is loosely placed in the neck of the flask [containing the zinc solution at 80 degs. C.] and a moderately rapid stream of gas allowed to pass through the hot liquid. When the precipitation of the zinc as sulphide is well under way, the stopper is pushed in tightly. Absorption of the gas ceases when all the zinc is precipitated; the precipitate settles quickly, and the gas pressure rises rapidly when the operation is completed. When the preceding operations have been properly performed, the precipitated zinc sulphide will be pure white, pulverulent and very easily filtered and washed. Hot water only need be used for washing; no zinc will dissolve, or pass through the filter, as is the case with slimy zinc hydrosulphide precipitated from cold solutions in the usual manner. Pour the contents of the flask upon a filter at once and wash with hot water. Spread the filter with its contents upon a large watch-glass or on the inner wall of a capacious beaker and wash the precipitate into the bottom of the beaker by a jet of hot water. Wash the precipitating flask and the lower end of the gas delivery tube with 10 c.c. of strong hydrochloric acid, followed by hot water, pouring the acid and washings successively over the washed filter on to the precipitate in the beaker. When the volume of the acid solution has reached 125 to 130 c.c., the solution is warmed gently to dissolve the zinc sulphide completely."

The solution of zinc sulphide in dilute hydrochloric acid is heated to 60 degs. or more, made up to 200 c.c. with hot water, a little ammonium chloride added and it is ready for titration with ferrocyanide.

LEAD AND IRON.

The methods are practically the same as for the determination of these elements in brass. Weigh from 3 to 10 grams, according to the amounts of lead and iron suspected in the spelter, place in a casserole, and add 50 c.c. of water, and then, a little at a time, sufficient nitric acid to dissolve the entire quantity of metal weighed out. Allow the solution to cool, add 10 to 15 c.c. of sulphuric acid, and evaporate slowly to dense white fumes. Cool, add 30 c.c. of cold water to dilute the free sulphuric acid, and then 200 c.c. of hot water and heat to dissolve soluble sulphates. Cool the solution, and filter off the lead sulphate, observing the usual precautions for the filtration, washing, and ignition of this precipitate.

Add enough ammonia to the filtrate from the lead sulphate to re-dissolve the zinc hydroxide, bring to a boil, allow the ferric hydroxide to settle to the bottom of the beaker, and filter while hot.

(To be continued.)

NOTES ON SLUSH MOLD CASTING FROM THE ANTIMONIAL LEAD ALLOYS

By Chas. H. Proctor.

CHARLES H. PROCTOR.

Presuming that the molds are made in a proper manner, that the gates are properly proportioned and due allowance made for the escape of the air in the mold by proper venting with a new mold; the first treatment should be as follows:

Heat the several parts of the molds by the aid of a Bunsen flame, a charcoal fire or a clear coal fire so that when dry pulverized sulphur is applied with a painter's small sash brush, the metal becomes coated with an even coating of dark oxide. The molds should not be so hot that the sulphur ignites into a flame. The next operation is to prepare a very thin mixture of finely pulverized jewelers' gold rouge mixed with water while the mold is still hot; this mixture is applied evenly with a brush of the description mentioned. This method of coating the mold is known as the parting, and enables the metal to run sharp and distinct, and prevents the metal from sticking to the mold.

A substance known as red French chalk is also used for the same reason as above mentioned. This is used dry and rubbed over the sulphur coating, but in practice the rouge coating gives the best results. Smoking of the molds is oftentimes used by holding the part over a gas or kerosene lamp flame. A coating of lampblack is obtained, but this method should only be used on particular occasions or on solid work.

In slush mold work when casting figure work or other one-piece slushed work, and the weight of the coating is too heavy, due to the extreme thickness of the metal in the upper portions of the figure, viz.: head or shoulders, smoking then will be found of an advantage, but should only be applied to the section where the metal is found to be the thickest. This will help the metal to run away more free from this particular section, producing a more uniform weight and thickness. When it is found that the casting runs too heavy, although uniformly, and it is desirable to reduce the whole weight of the casting and it is found impossible to accomplish this without having a number of very thin spots in the casting, then it is advisable to shorten the gate by sawing off part of it, sometimes one inch; other times, two or more. This enables the caster to run out the excess metal from the mold more rapidly, thereby producing a lighter weight casting. When holes persistently occur in the castings, then additional vents will have to be added in the mold, covering the particular section where the holes occur. This will remedy the trouble by allowing the air to escape, which becomes compressed by the weight of the metal and expanded by heat. When the metal is overheated the casting will be spongy and holes will be found below the surface when polishing; when the metal is too cold heavy streaks will be found in the metal, which are known as cold spots. This can be overcome by either increasing the temperature of the metal or mold.

Gates on castings are sometimes difficult to break away without sawing off; in this case, coat the edges of the gate with silicate of sodium, commonly known as water glass. This prevents the adherence of the metal to the mold, and is commonly termed stopping off. It is largely used on parts of the mold to save drilling and reaming where large holes are required. In producing large castings of considerable length it is desirable to pour the metal as steadily as possible so that an even flow may be procured; with the old-fashioned bell gates this is impossible. The gates should be made on an angle on the lower side, so that the highest part of the gate will be slightly above the center of the mold; this assures an even, steady flow and allows the air to pass out of the gate, insuring a good casting.

For light castings with fine detaiis, 14 per cent. antimonial lead should be used; for casting of medium weight, 12½ to 13 per cent., and for exclusive plain work, 11 to 12 per cent. can be used satisfactorily. Dry wood or coal ashes will be found a very effective cleanser for antimonial lead. Arsenic, which is always present, can be brought to a minimum by covering the molten metal at night with wood ashes and skimming off in the morning.

PRESERVATION OF RADIUM.

United States Consul Albert Halstead, of Birmingham, transmits the following article from the Daily Post, of that city, concerning a radium safe:

"A remarkable safe, the first of its kind ever constructed, has been made by an English firm of safe makers for the British Radium Corporation. It has been specially constructed for the storage and protection of radium, and though only about 3 ft. in height it weighs a ton and a half. Great ingenuity has been exercised upon the design and construction in order to make it, as far as possible, proof against the skill of the most expert burglars and against all risks of loss by emanation. Experiments proved that practically the only metal which would withstand the great penetrating power of radium emanations was lead, but as this was not at the same time burglar proof the only solution was to construct a safe with an interior of lead and an exterior of steel. The interior shell was made of 3-in. lead and the outer casement of a similar thickness of steel. Another difficulty was the fitting of the door to prevent the escape of any ray of light. This was secured by constructing a circular lathe-turned door which has a 'dead' fit, and has a specially ingenious contrivance for immediately remedying any wear and tear caused by opening and shutting the door. Another safeguard which had to be taken was to prevent loss of emanations when the door is opened. To overcome this, two valves have been fixed into the door through which tubes of mercury will be passed for the collection and storage of the emanations."

The daily press states that Mme. Curie, Chief Professor in the Faculty of Sciences of Paris University, announced Sept. 6 to the Academy of Science that she had succeeded in obtaining pure radium. Hitherto radium had existed only in the form of salts. Mme. Curie, in conjunction with Prof. de Bierne, treated a decigram of bromide of radium by an electrolytic process, obtaining an amalgam from which was extracted the metallic radium by distillation. It has the appearance of a white metal, and is capable of adhering strongly to iron.

EDITORIAL

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POSSIBILITIES OF ALLOYS.

In the July, 1909 issue of THE METAL INDUSTRY there was published an article relating to the part that metals played as a factor in air ships. At the close of the article the remark was made that sooner or later a metal would be discovered that would be entirely suitable for use in airship construction. The writer of the article ventured a prophecy as to the necessary requirements of such a metal. He said that in his opinion such a metal would have a specific gravity of between 1.5 and 2.5 and a tensile strength of at least 40,000 lbs. per square inch.

In this issue of THE METAL INDUSTRY is published an account of a new alloy lately invented in Berlin. This alloy is one of a series of alloys to which the name Duralumin has been given. The published qualities of this metal are remarkable in every respect. Containing from 90 to 95 per cent. of aluminum, the gravity is given as 2.8, and the tensile strength at 62 kilograms per square millimeter, or 88,000 pounds per square inch!

At this writing it is impossible to state what the other 5 or 10 per cent. of the alloy is composed of, but this will undoubtedly be disclosed before long. As far as we know, the alloy has not yet been patented, but if the metal will do all that is claimed for it, it probably will be, and then we will be able to talk more intelligently regarding its composition and preparation.

Of course all kinds of speculations are in order regarding this new alloy, and the one that comes foremost to the mind of the metallurgist, is that this may be merely the result of some special laboratory experiment. But when such a firm as Vicker's Sons & Maxim take the matter up, and as a result of their investigation, place an order for six tons of the new metal, we must believe that what we hear is true. There are, of course, unlimited uses for which such a metal can be put, chief among them being the airship and motor boats.

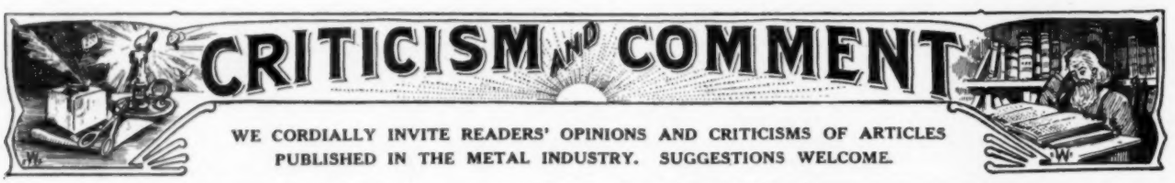
Aluminum alone has not exactly lived up to the claims formerly made for it, in that in the case of the airship it did not prove reliable at all times under stress, as it could not be depended upon for the necessary strength. In the case of the water craft, the action of the salt water rendered it worthless as a factor in the construction of exposed parts, such as shafts and propellers. Now, however, we have promised us a metal that will combine the lightness of aluminum with the strength of steel and the uncorrodibility of manganese bronze! The metallurgical world awaits with great interest further particulars of Duralumin.

STANDARDIZATION OF FOUNDRY FLASKS.

A correspondent in another column of this issue of THE METAL INDUSTRY calls attention to a scheme for adopting a standard size of foundry flask. What he means, is to have the flasks so made that when a match plate of patterns is made for one flask, a flask of another manufacturer will fit and the pins will register so that no side-slip will occur. This is a much mooted question, and while we think our correspondent's idea is a good one, we fear that it will not be looked upon with favor either by flask manufacturers or foundry. Anyone having a match pattern plate could go from one foundry to another, assured that flasks would fit and be the same, and it would undoubtedly be of great service to such consumer.

On the other hand the foundry business already offers great opportunities for competition, and the standard flask question would certainly increase rather than decrease competition. The only hold that some foundries have on certain lines of business is because they have the "proper flasks," and with this particular anchor removed, it becomes a question of almost entirely one of price to keep the trade. However, the idea is an excellent one, even though it has been advocated before, and, after all, the results, should it finally be adopted, would be for the greatest good to the greatest number, and this is what business is for.

In this age of specialization and standardization, it is to be expected that opposition will be met with in the putting forward of new ideas. But we progress and we very often find men, at first violently opposed to a proposed reform, finally appearing as its strongest advocates. Who knows but in the near future we shall have the "standard foundry flask beside the "standard crucible"? THE METAL INDUSTRY invites suggestions and criticisms of the idea.


CRITICISM AND COMMENT
WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY. SUGGESTIONS WELCOME.

NEW BOOKS

The Chemists' Pocket Manual. By Richard K. Meade. Size, 6¼ x 4 ins.; 444 pages; 39 illustrations. Bound in leather. Price, $3. Published by the Chemical Publishing Company, Easton, Pa.

A second edition of a book of formulas, tables, calculations, physical and analytical methods for the use of chemists, chemical engineers, assayers, manufacturers, metallurgists and students. The compiler has added many new tables and augmented the section on analytical work by considerable new material.

The book is divided into two parts, one of which is general and deals with weights and measures, conversion tables, specific gravity of acids and alkalis, physical properties of gases, calibration of apparatus, volumetric solutions and analysis, qualitative analysis and assaying. The other is concerned with select methods for the technical analysis of substances such as iron, copper and lead ores, blast furnace slag, bearing metals, coal, gases of all kinds, water for both drinking and boiler feed, Portland cement, lubricating oils and soap. This is a most valuable book for manager, chemist, assayer and in fact any kind. For sale by THE METAL INDUSTRY.

"TWENTIETH CENTURY SHEET METAL WORKER."

A Modern Treatise on Sheet Metal Work. By H. E. Osborne. Size 5¾ by 7¾ inches; 86 pages; illustrated by sketches. Price $1.00. The American Artisan, Chicago, Ill.

The compilation of this book was attempted with the idea of producing a popular priced pocket reference book of short-cut rules and quick methods combined with accurate information for the tinner. The book is filled with shop kinks and instantaneous helps and can be easily understood by the youngest apprentice and at the same time is of sufficient practical use for the journeyman. For sale by THE METAL INDUSTRY.

POSITION OF WORKMAN FOR POLISHING.

To the Editor of THE METAL INDUSTRY:

In the Criticism and Comment column of your August number I note a reply to M. F. Schultz's question, "Should a Polisher Sit or Stand While Working?" by C. L. Puffer.* He has done well, and I heartily agree with him that "it depends upon the man more than on the kind of work he is doing, and how he was taught or learned to do the work.

I am a foreman polisher and plater, have been for twelve years, and have been at the trade for twenty-seven years all told, and have done all kind of polishing myself. There is a great advantage in sitting down and using one's knees to rest the arms on and by having the feet on a good, substantial footrest an upward pressure is obtained. In fact, on heavy work that is not too large to handle sitting down, I believe a man can do more and better work sitting than standing, and besides not get as tired, although polishing heavy work is tiresome, no matter what position you assume while doing it. On small light work, of course, sitting is the proper position. I have been able to polish 8x10 and 10x10 brass, iron and bronze butts easier sitting than standing, while the man next to me could not do them sitting down at all and only one-half as many while standing. So it all depends on the man.

I believe every man working at the polishing machine should have a stool and footrest, no matter what the work may be, as there are times during the day that he might wish to sit down for a while for a rest if for no other purpose. The position a man is in while polishing should be determined by the man in charge of the room, and proper stools and footrests supplied. A foreman should KNOW how to do each and every piece of work under his charge and be able to show his men how to do it. If he can do this, the question of sitting or standing will not bother him.

T. C. EICHSTAEDT.

Pontiac, Mich., August 15, 1910.

To the Editor of THE METAL INDUSTRY:

In the past few issues of THE METAL INDUSTRY I have noticed several articles in regard to the polishing of metals, one an inquiry as to position a workman should assume, another a description of wheels, etc., and also answers to the inquiry in regards to the position a workman should be in. It depends a great deal on the class of work, but more especially upon the class of workman. A workman that knows his business will know what position he should be in to finish any article given him. I am well known and have been in charge of concerns around New York for the past eight years, and the greatest trou-

*THE METAL INDUSTRY, April, 1910.

ble I ever had was not in what position a workman should be in to finish an article, but in getting the men that know the position that they should be in. In most brass brass shops the work is done standing up, except where work is very heavy, then it is either sitting down or swinging lathe. Also, in different parts of the country different conditions prevail. In one instance, on stove plate in the West it is standing up, around New York it is sitting down. Chandelier work, East and West, standing up, but yet you will find the lathe on the floor in most places for sitting down, so I think the best way out of it for the inquirer is to assume a position adaptable to the class of work he has on hand, according to the conditions surrounding him.

S. HERRICK.

Southington, Conn., Aug. 15, 1910.

FLEXIBLE POLISHING WHEEL VERSUS GLUED WHEEL.

To the Editor of THE METAL INDUSTRY:

We thought possibly our views might be of interest to you on the subject of flexible emery wheels. We considered making such a wheel some time ago, but found that it would be a great deal more costly for the user than some of the various other styles of polishing wheels that do not compensate for the cost of advertising. The wearing service being cloth or paper, would wear down very fast, and the renewals would be expensive. The cost of coating an ordinary polishing wheel with emery and glue is very small, a matter of from 1c. to 3c. perhaps, and there is nothing in the polishing or grinding business as good as the grain emery glued onto the polishing wheel, the wheel itself lasting for years. The only advantage a wheel of this type seems to have over a solid emery wheel is in being flexible and fitting the contour of irregular shaped pieces, but this is a matter that is taken care of by a flexible polishing wheel with emery glued to the face.

We could make these wheels very easily, but they appeal to us only as a wheel which would attract attention, and while we send out a great many sample wheels, six months afterwards we could not induce a man to take one as a gift if he figured out the cost of using it.

(Signed) B. H. DIVINE,
President Divine Brothers Company.

Utica, N. Y., Aug. 13, 1910.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ALLOYING

Q.—Is there anything that we can add to an alloy consisting of three-fourths zinc and the balance aluminum, copper and tin that will give it the color of bronze or old gold without impairing the quality of the metal?

A.—The only way that you could obtain a bronze or old gold color on the alloy you mention would be by brass plating it.—J. L. J.

BRIGHTENING

Q.—Please publish a formula for a bright copper.

A.—For a brightener for cyanide of copper baths, the following formula is used:

Caustic soda	2 lbs.
Dry carbonate of lead	1 lb.
Cream of tartar	½ lb.
Water	1 gal.

Dissolve by the aid of heat or by using boiling water. Add one-half ounce or less to each gallon of solution, or, better still, sufficient to give you a bright deposit.—C. H. P.

COLORING

Q.—Kindly publish formulas for Jap bronze and steel blue solutions.

A.—Steel blue color can be produced upon brass by immersion in a solution composed as follows:

Sodium hyposulphite	8 ozs.
Acetate of Lead	4 ozs.
Water	1 gal.

The solution is used at the boiling temperature. A number of colors can be produced from this solution according to the length of immersion.

For Japanese bronze the articles must be previously copper plated. For this tone the acid copper solution gives the best results. After coppering the articles are immersed in a solution consisting of:

Sulphurett of potassium	½ oz.
Water	1 gal.
Ammonia	A few drops.

This solution is used cold. Immerse until a dark brown tone with variegated colors is produced, which will be in a few seconds. Then remove, wash, dry out and scratch brush by the aid of a soft brass wire brush or one that is considerably worn. This will produce the Jap bronze tone. A little experimenting will be necessary to produce a uniform finish on all articles. Both finishes should be lacquered with a good heavy lacquer after coloring.—C. H. P.

Q.—Will you kindly publish the formula for colors used in coloring building hardware, tools and cast iron implements?

A.—These colors are mostly all lacquers and are prepared by dissolving any required aniline color in denatured alcohol producing a concentrated solution. Then add to any lacquer. The colors are usually blue, green, red, brown, and greenish yellow. On many articles bronze powders are used. These are mixed with gold size and applied with Fitch varnish or camels hair brushes.—C. H. P.

CASTING

Q.—Will you please inform me how we can avoid those spongy places in flat castings? The metal we use is clean scrap from clock works, and is all yellow brass.

A.—The spongy areas in your flat brass castings are due to shrinkage. Adding a little copper to the brass scrap used will be beneficial. As you cannot very well chill castings of this character or put risers on them, you will have to skin-dry the molds and increase the heights of your pouring gates so as to bring an increased pressure on the molds.—J. L. J.

FINISHING

Q.—Kindly advise us if you know of any method whereby we can obtain a bright finish in brass plating without tumbling?

A.—If your brass solution is in proper condition a good bright deposit should be obtained. This is usually accomplished by adding a small amount of arsenious acid or white arsenic dissolved in caustic soda (one part arsenic to three parts soda), dissolved in boilng water. Care must be taken not to add too much or the deposit has a grayish tone. The latest method to polish brass plated articles by tumbling is to use steel balls and a solution of borax and water.—C. H. P.

LINING

Q.—Please advise us as to the best method of lining plating tanks.

A.—You do not state what solutions you intend to use. If brass, copper or bronze, then boiler plate iron tanks will give the best results, especially if it is intended to heat the solutions by any of the usual methods, otherwise for these solutions wood tanks unlined give results, but the iron tanks are preferable because in their use the danger of leakage is overcome. For nickel or silver plating or any solution that is used cold, wood lined tanks give excellent results. The method used by a well-known platers' supply house will prove most satisfactory for the purpose. It is as follows: All seams and corners should be covered with cheese cloth, which is applied by coating the seams and corners of the tanks with coal tar, using a brush for the purpose. The cheese cloth is applied in strips. The coal tar holds it in position after this is accomplished. Coal tar pitch is melted in an iron kettle and just a little coal tar is added to render the pitch less brittle. The mixture is brought to a boil and applied evenly all over the tank, while hot, with a good sized oval paint brush. After the tank is completely covered with a uniform thickness, which will probably be not less than one-eighth of an inch thick, then finely sifted sea sand should be heated in an iron kettle until good and hot. The tanks are first placed on their sides and the hot sand sprinkled over the pitched surface. The whole surface of each side is completely covered with the same, which, being hot, penetrates the pitch and forms a surface similar to asphaltum sidewalks. The excess of sand is brushed from the surface with a regular hand brush. A roller made up from a piece of 1½-in. iron pipe is now used with pressure to even the surface, which should be accomplised while the surface is soft. The remaining sides and ends should be finished in the same manner, finally the bottom. This method is one of the best in use, and when properly applied the tank will last for years and very seldom leak.—C. H. P.

PLATING

Q.—Will you please give me the formula for the best 22-carat gold solution for satin finish with a deep rich yellow color?

A.—The following formula will give you the desired results, providing you use the proper regulation of the current, which should be from two to three volts and a temperature of 150 to 160 degs.:

Water	1 gal.
Phosphate of sodium	8 ozs.
Bisulphate of sodium	1¼ ozs.
Cyanide of potassium	⅛ ozs.
Pure gold converted to chloride	2½ dwt.

If commercial chloride of gold, purchased from chemical houses, is used, then take not less than six pennyweights of the chloride. A platinum anode gives the best results, which should be manipulated according to the surface to be gilded. Too strong a current or the exposure of too much anode surface produces a reddish tone.—C. H. P.

Q.—Will you please give the following information in your Shop Problems columns?

1. Formula for a brass solution, to deposit a heavy coating in about two hours.

2. State reason for the grain in iron rods always showing the zinc on the edges of the cracks in brass plating.

A.—No. 1. A brass solution for your purpose should consist of the following:

Carbonate of copper	3 ozs.
" " zinc	1 oz.
" " soda	4 ozs.
Cyanide of potassium	8 ozs.
Water ammonia	½ oz.
Water	1 gal.

To prepare the solution dissolve the soda in ½ gallon of hot water, then add the copper and zinc. Dissolve the cyanide in ½ gallon of warm water, then add with stirring to soda and copper salts, afterwards add the ammonia. Use anodes of sheet of cast brass. If the solution deposits dull, dissolve ¼ lb. white arsenic in ½ lb. caustic soda in one quart of hot water. Reserve this as a stock solution. Add about 20 drops to each gallon of solution or less. Too much arsenic produces a grayish brass.

2. The zinc shown on the edges of the rods mentioned may be due to carbon in the iron. If the brass solution is plentifully supplied with copper this should not occur.—C. H. P.

REMELTING

Q.—What is the best way to get a good color of castings when remelting scrap?

A.—The best way to get a good color of castings when remelting scrap is to melt the scrap in an open flame oil furnace by means of which most of the iron is burned out. The metal is well poled to thoroughly clean it and then about one-half pound of 30 per cent. manganese copper is added for each hundred pounds of the scrap brass.—J. L. J.

SOLDERING

Q.—We have to solder a seam of a German silver tube, which is ½ in. in diameter and 5 ins. long, and would like to know if you can give us a flux which will work in the best possible way?

A.—The best material for soldering German silver tubes is silver solder, which as ususally made consists of equal parts of coin silver and sheet yellow brass. Fused borax, finely powdered, is the flux generally used.—J. L. J.

STAINING

Q.—Why do we have trouble from staining on pure yellow brass castings of staple fittings. We use the regular bright dip acids properly mixed but have to use hard water for rinsing. How can we overcome this trouble?

A.—Your trouble occurs from the porosity of some of your castings, which become impregnated with acid, which is not thoroughly removed by the cold water washing and is thus carried into the boiling rinse water, which produces the stain. To overcome this difficulty add about one ounce of Platter's compound to each gallon of boiling water. This solution should be renewed when it becomes greenish on account of the neutralizing effect of the dipping acids.

By this immersion your castings will be free from stains and will dry rapidly, if the solution is maintained at a low boil. Platter's compound can be obtained for this purpose from dealers in platers' supplies.—C. H. P.

TARNISHING

Q.—We are having great difficulty at present with phosphor bronze wire tarnishing after being cleaned in sulphuric acid, washed and dried off in an oven heated with gas. Can you tell us how to prevent this?

A.—You can overcome your difficulty of tarnishing by the following methods: First, after pickling in sulphuric acid, wash well in cold water. Then immerse in boiling water, to which is added 1 oz. of whale oil soap to each gallon of water. This will prevent tarnishing providing the wire does not come in contact with gaseous fumes.

In the United States wire of all sizes is being dried out by centrifugal force. This method frees the wire from moisture and in a short time is perfectly dry.

The immersion in soap solution will probably prevent the tarnishing even when dried out by gas.—C. H. P.

Q.—Will you please publish in your journal a cheap method of treating copper plated art glass to keep it from turning black? We do a great deal of this kind of work and plate it in a cyanide solution, but we have always had trouble in keeping it from turning black after plating.

A.—Rub the surface over with boiled linseed oil, diluted with turpentine.—C. H. P.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

965,871. Aug. 2, 1910. MANUFACTURE OF IRON-NICKEL ALLOYS, G. H. Clamer, Philadelphia, Pa.

The principal object of this invention is to provide for making, direct from ore containing nickel and copper and iron in the form of sulfids, a homogeneous alloy of the metals named which is of whitish color, practically non-corrosive, possessed of a low co-efficient of expansion and of great mechanical strength, which can be rolled into sheets, rods and the like, and which can be comparatively cheaply produced.

The alloy can be made within the following range of proportions by weight:

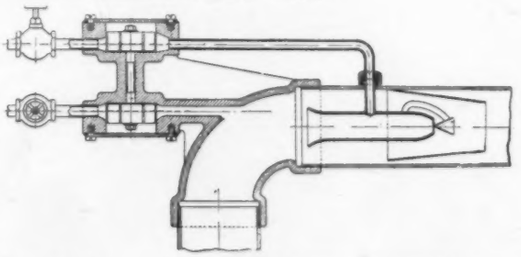
Nickel	25 to 50%
Copper	5 to 20%
Iron	30 to 70%

There may be present a small amount of impurities, such as would ordinarily exist in commercial steel, copper and nickel and the presence of carbon in limited proportion does not cause separation. The strength of the alloy depends upon the carbon content, so that in each case the carbon content is to be determined by providing enough carbon content to insure the required mechanical strength, yet not enough carbon content to produce hard metallic nodules.

The addition of any of the three metals, copper, nickel or iron may be made to bring the alloy to the desired proportions which are those within the limits above given. In the finished alloy there is present some or all of the iron which was present in the ore. The desired method of production is comparatively inexpensive, simple and expeditious.

966,124. August 2, 1910. SPRAY BURNER. A. T. Rigg, Altoona, Pa.

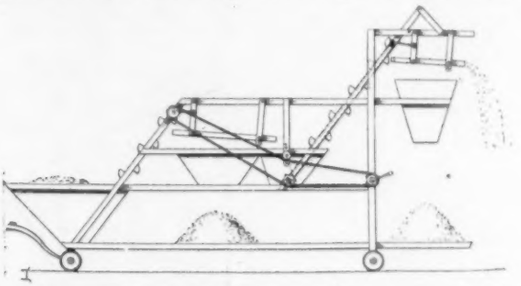
By this invention means are provided, as shown in cut, for uniting the hydrocarbons of the fuel with the oxygen of the air that is forced into the furnace through the burner from the bellows or other suitable pressure supply.



The apparatus consists of an oil burner comprising a blast pipe, fuel focusing and mixing elements within the blast pipe, a bladed rotary oil agitator, a rotary air motor having a direct shaft connection with the agitator, means for supplying oil to the agitator, means for conducting atomized oil from the agitator to the elements within the blast pipe, and means for feeding air under pressure to the air motor.

966,294. August 2, 1910. SAND-CLEANING MACHINE. Henry Arps, Rogers, Neb.

This invention covers a machine as shown in cut, designed to grade sand into coarse, medium and fine. A brief description of the machine is as follows. A platform or base is mounted upon suitable trucks or wheels, and a tongue extension attached to the forward truck is adapted to be utilized in moving the sand machine from place to place. Located over the forward truck is a hopper, in which is placed the sand before it starts through the grading process. A frame, the base of which is secured to the platform, carries a belt and a plurality of elevator buckets which move around a suitable pulley secured in the frame, and the buckets in their continuous movement are adapted to carry sand from the hopper and so dump it in order to fall upon a sieve, said sieve being suspended from a cross standard and carried by upright bars. The first step of grading the sand is completed after the sand has passed through the sieve down into

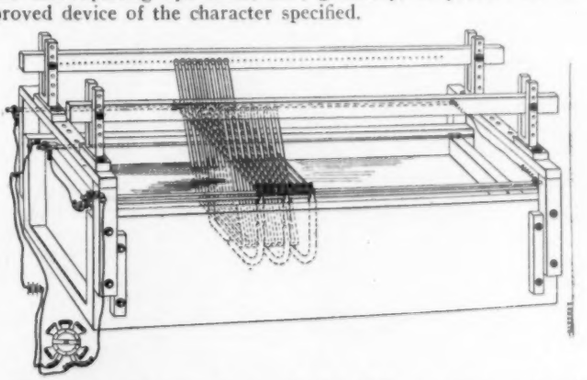


a funnel-like member, which is supported by a cross-beam. The sand after passing through the funnel-like member is deposited upon the platform. The grains of sand which are too large to pass through the sieve are thrown into a second hopper.

968,622. Aug. 30, 1910. ELECTROPLATING TANK. E. R. Williams, Streator, Ill., assignor to the Streator Metal Stamping Company, Streator, Ill.

This invention relates to the general art of the electro-deposition of metals to form a coating or plating, and has reference more particularly to a device for effecting the economical and rapid electroplating of U-shaped articles, such as handles of go-carts and the like.

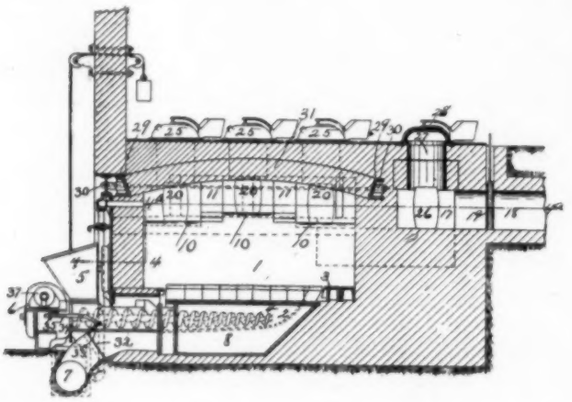
Among the main objects sought to be obtained by the invention are, to increase the working capacity of electroplating tanks of this type; to reduce the time period heretofore usually required to effect the operation; to effect a more uniform and even deposition of the plating or galvanizing metal; to provide a means for easily and quickly adjusting the extent of surface subjected to the electroplating operation; and, generally, to provide an improved device of the character specified.



To these and other minor ends the device of the invention in its preferred form is generally characterized, as to its novel features, by the provision of a galvanizing tank, shown in cut, equipped with one or more vertically adjustable rack bars mounted thereabove to support the handles or other devices at any desired depth in the solution, together with a series of curved anodes that are suspended from anode rods disposed lengthwise of the sides of the tank and project inwardly toward each other beneath the lower ends of the handles and at a substantially uniform distance from the latter, and contact rods disposed transversely of the tank and in contact with the handles, said contact rods themselves being in electrical connection with one side of the generator while the anode rods are connected to the opposite side of the generator.

969,066. Aug. 30, 1910. MELTING-FURNACE. J. A. Leiter, and C. P. Oakman, Erie, Pa. Assignors to The American Stoker Company, of Erie, Pa.

The invention has for its object the making of a melting-furnace of such design that ordinary fuel such as coal will be readily used. The furnace is peculiarly adapted for melting such metals for use in brass foundries.



Referring to the cut, 1 marks the combustion chamber in which are arranged the grates 3. The conduit 2 is arranged in the center of the grate surface and is provided with the scew 4, through the action of which the fuel is fed into the conduit over the grate surface. Fuel is introduced into the hopper 5 and carried forward by the screw 4. The screw is operated by an engine 6 which may be of any desired construction.

Air is delivered to the furnace through a main pipe 7. One passage from the main passage communicates with the wind box 8 immediately under the conduit 2, and delivers air to the furnace adjacent to the conduit. Separate pipes lead from the pipe 6 and deliver air to the grate surface, the air being delivered to the furnace through the grates.

The hearths 10 extend laterally from the combustion chamber above the grate surface. The hearths are divided into compartments by the baffles 11, each compartment being designed to receive a crucible in which the metal is melted. The baffles are preferably formed with the curved walls, so as to give an equal space around the back part of the crucible. Flues extend from each compartment and open into a common flue, which extends toward the back of the furnace and ends in a reheating furnace 17. All the products of combustion of the furnace are united in the reheating chamber and pass to the stack through a flue 18. The flue 18 is controlled by a damper 19.

The crucibles 20 are introduced through openings in the top of the furnace, there being one opening for each compartment. The edges of the hearths have raised shoulders which prevent the molten metal from passing down into the grate surface. At the rear of the hearth is a trough through which any metal which overflows may escape to the front of the furnace.

The roof of the furnace directly above the hearths is of such height that the upper edges of the crucibles extend into the openings 21, This is desirable for two purposes. It keeps the crucibles from upsetting into the furnace by reason of the fact that the upper edges of the crucibles will contact the edges of the openings 21 and also because of the fact that it protects the upper edges of the crucibles from the direct action of the flames, thus prolonging the life of the crucibles. Each opening is provided with a swinging cover 25 of ordinary construction. The reheating chamber 17 is provided with the openings 27 through which the crucibles 25 may be introduced. Each of these openings are provided with the swinging covers 28. By using this reheating chamber the crucibles may be kept hot while in use.

INDUSTRIAL

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

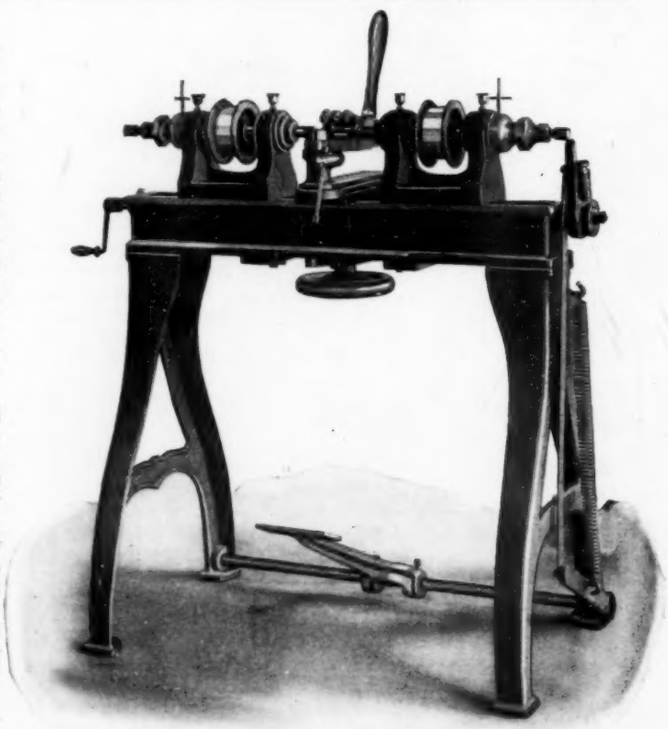
SCHULZ DOUBLE HEAD RIVET SPINNING MACHINE.

The machine shown in cut is manufactured by Fritz A. Schulz, 218-230 N. Jefferson street, Chicago, Ill., and is now being placed on the market. The machine is equipped with two spindles, which rotate in opposite directions, each spindle being independently driven by its own belt. Three sizes of this machine are now being manufactured, the spindle carriages of No. 1 machine are adjustable to any nature of rivet up to 10 inches and has a capacity of ⅜-inch stock. Spindle carriages of No. 2 machine are adjustable up to 24-inch lengths and have a capacity of ⅜-inch stock. Spindle carriages of No. 3 machine are adjustable to 28-inch lengths and have a capacity of ⅝-inch stock. The bearings are of the well known Schulz double cone type and manufactured from the very best phosphor bronze that it is possible to obtain. The method of adjusting and taking up wear in the bearings is the same as in the Schulz metal spinning lathes, which have gained an enviable reputation for accuracy and durability.

It will be noted that the cut does not show an improved method of feed which has but recently been added, this consists of: Jaws for gripping work being set in a quick action vise, the lever of which is connected to foot lever so that pressure on latter also closes vise, making it unnecessary for the operator to touch the machine with his hands after it is once set for certain work. Having both hands to handle work with, greatly increases the amount of work turned out. Machines can also be used for machining, end milling and finishing parts, both sides in one operation.

This manufacturer also makes metal spinning lathes, metal spinning tools, oval chucks, steel split chucks, pipe threading machines, blacksmith, coppersmith and brass workers power hammers, hand, foot and power drive punch presses.

Further information and catalogue can be obtained upon request.



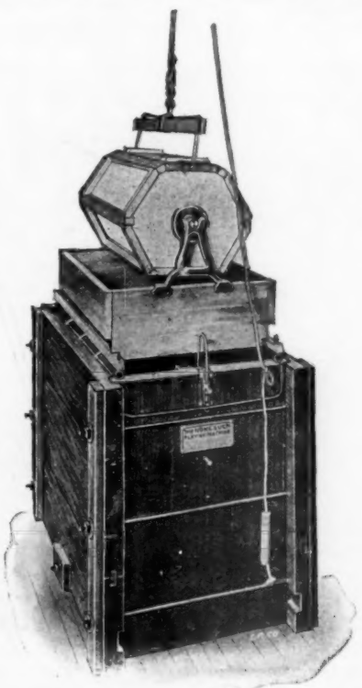
SCHULZ DOUBLE HEAD RIVET SPINNING MACHINE.

THE "NONESUCH" ELECTROPLATING MACHINE.

Rockhill & Vietor, 114 John street, New York, have taken the sales management of a new electro-plating machine invented and patented by S. C. Catlin, of Bloomfield, N. J. This plating barrel, called the "Nonesuch" has a number of unique features which recommend it to the consideration of all platers. One of the principal improvements is the special canvas panels in the barrel, which can be renewed when necessary at a trifling cost compared with the usual panels of wood, hard rubber or celluloid. In the "Nonesuch" machine the panel offers practically no resistance to the current, the whole area when saturated with the plating solution presenting no more resistance to the current than does the plating solution itself. This insures rapidity and uniformity of plating. In panels of perforated rigid material the electric current must pass only through the perforations, which have a total area of but a small part of the area of the whole panel, while with canvas panels the current is practically unobstructed.

The manufacturers of the "Nonesuch" machine state that the flexibility of the canvas panels adds surprisingly to their durability. Their light weight makes the cylinder convenient to handle. However, any plater who prefers rigid material for the panels can use it, as the machine is so constructed that either kind can be installed.

Other features to which the manufacturers call particular attention are the improved cathode connections, there being no shaft running through the tank to cause leakage and no shaft running through the cylinder to interfere with the movements



SINGLE BARREL MACHINE WITH TRAY FOR UNLOADING.

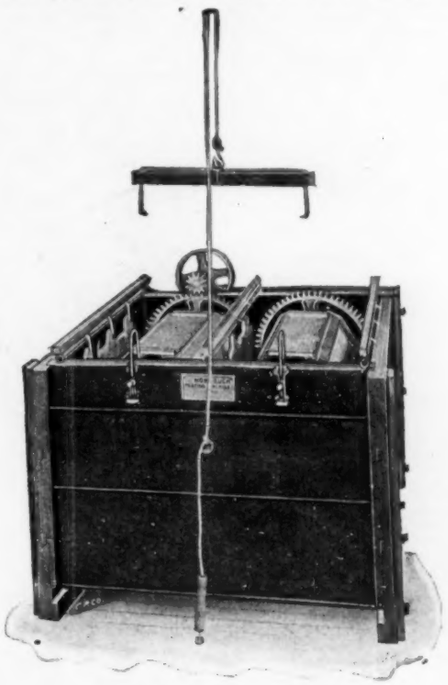
of the articles that are being plated. The cathode electrodes take up very little room and are all simple and easily attached or detached.

Another new feature is the tray which permits the cylinder to be raised from the solution and properly drained and emptied. When emptied the cylinder is placed in the tank and new work ready to plate is emptied into the tray and falls through the chute directly into the cylinder.

One combination tray and chute answer for a machine having any number of cylinders. At present the machine is built in two sizes containing one and two cylinders each, respectively. Larger sizes are built to order.

The "Nonesuch" machine is the invention of an electro-plater of 35 years practical experience. He has spent several years in developing it. It has been thoroughly tried out in a number of prominent factories and is now in use by a number of leading concerns, including: The Oakville Company, Oakville, Conn.; R. C. Jenkinson & Company, Newark, N. J.; Bridgeport Electro-Plate Company, Bridgeport, Conn.; United States Pin Company, Arlington, N. J.; Consolidated Pin Company, Bloomfield, N. J.

The prices quoted by the selling agents are claimed by them



DOUBLE BARREL MACHINE.

to be lower than those quoted by any other manufacturers of plating barrels of similar capacity. Further information and quotations can be secured by communicating with Rockhill & Vietor, 114 John street, New York.

ELECTRICAL ALLOYS.

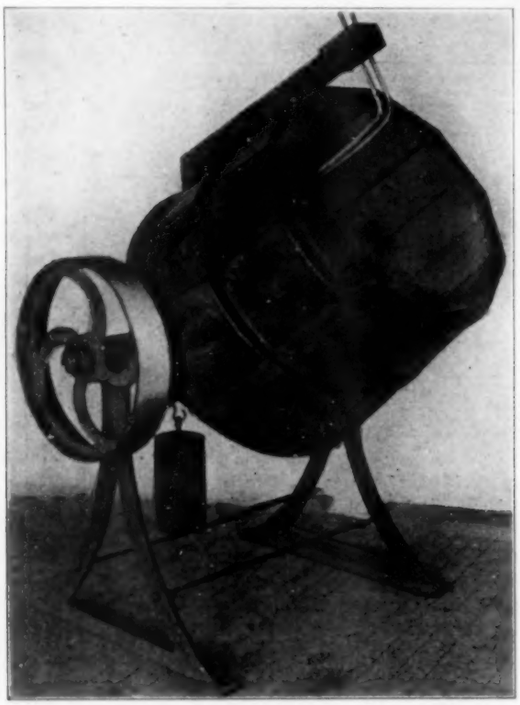
The Electrical Alloy Company of Morristown, N. J., are making a specialty in drawing, timing and slitting of brass, bronze, copper, steel, aluminum and special alloy, such as nickel, copper, etc. They call particular attention to the fact that they are prepared to draw from ⅜ and ¼ inch rods down to 40 B. and S. gauge and finer and also special shapes of all kinds, semi-circular, octagonal, triangular, diamond shaped, etc.

This company manufactures all kinds of high class electrical resistance materials which are being used by the most important manufacturers of electrical apparatus, both in America and abroad. Among the products that they manufacture and keep a large finished stock of on hand, thus ensuring prompt delivery are: "Phenix" wire, a high-grade nickel steel alloy with a specific electrical resistance of 524 ohms per mile feet, "Ideal" and "Nico" wire high-grade cupro-nickel alloys, of high specific resistance and temperature co-efficient practically nil, Aluminum wire of all sizes from 10 up to 40 B. and S. gauge, magnet wire, phosphor bronze, German silver wire and strips, 18 and 30 per cent. pure nickel wire, tinned armature building wire, copper ribbon and special wires for special purposes.

All alloys are furnished in the form of wire, sheet and ribbon. The company offer free experimental service and guarantee the highest efficiency with lowest prices for their materials. They have the latest machinery and what is claimed to be the most complete testing laboratory in the country, thus enabling them to solve the hardest experimental problems. The officers of the company are C. H. Stengel, president, and F. S. Reigart, secretary and treasurer. Catalogues, booklets and price lists will be furnished upon application.

A NEW OBLIQUE ELECTROPLATING BARREL.

A barrel which has been in constant use for the past five years has now been considerably improved and is pronounced by the manufacturers, The Klauder-Weldon Dyeing Machine Company, Amsterdam, N. Y., to give excellent results. This barrel, which is shown in the accompanying cut, is of the oblique type, which is claimed to possess numerous advantages for certain kinds of work over the horizontal form. The barrel is made of wood and is raised and lowered by means of a wormgear operated by a crank. The balance of the barrel is maintained by a counterweight fastened to its stem. The electrical connections are made through terminals which are fastened to a wooden support used to hold them in position. The electrical conductors, shown in the illustration, are directly connected with the terminals, the anode rod passing down into the barrel and is connected with the anode held directly over the work, the other or cathode rod being used for connecting the work being plated, this connection



THE "ACME" OBLIQUE ELECTROPLATING BARREL.

is affected by means of a chain which comes in direct contact with the work.

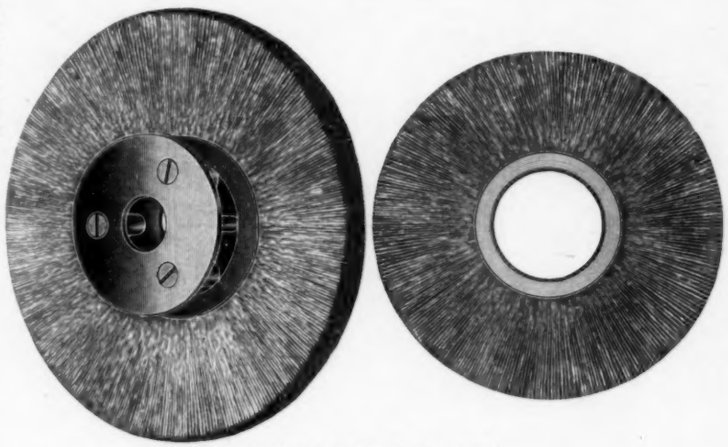
Some of the advantages claimed for this barrel may be enumerated as follows: Work may be plated in the smallest possible quantity of plating solution. The contents of the barrel may be inspected at any time so that the nature of the deposit is always under observation. Upon completion the finished articles are removed by simply tilting the barrel. All kinds of small articles, such as pins, hooks and eyes, too small to be plated in the horizontal barrel are easily and economically plated in this type. This barrel takes the place of baskets for small goods and can be used for plating of large as well as small quantities.

A large number of these barrels have already been installed, and very flattering reports are being received by the company as to the excellence of the results obtained.

A NEW PATENT SECTIONAL WHEEL BRUSH.

The American Wire Brush Company, 277 Greenwich street, New York, have just put on the market a new wire wheel brush which possesses several novel features which the manufacturers claim embody improvements over any brush heretofore made. These brushes are called "Mez" Improved Sectional Wheel Brushes and, as the name implies, are made in thin sections made up of corrugated wire arranged in the shape of hairpins and tied around a holding wire so as to form an endless, connected, circular tuft. Several of these sections may be put together and held in place by compression flanges. The individual rings, or sections may be used without a hub by simply slipping them onto a spindle between washers and tightening up the washers.

Brushes can be built up to become hard and close by joining a number of rings side by side, no separating washers being placed between the adjacent rings. Soft brushes can be secured by inserting cardboard or leather washers between the sections when building up the brushes. Any desired width of brush or



"MEZ" SECTIONAL WHEEL BRUSHES.

degree of hardness or softness can thus be obtained quickly and readily out of the same supply of rings by simply building them up as needed.

The manufacturers state that three standard sections will be found sufficient to produce the effect of a four-row old-style brush; five rings are equivalent to the old style six-row brush, and so on. No dirt can accumulate in these rings during use, as is generally the case with drawn brushes.

Any individual ring can be quickly replaced, and if a number of rings should be worn down to a smaller diameter than will suit the work, any number of rings so reduced in size may again be assembled into smaller wheels for use on other work.

"Mez" brushes are manufactured for all industrial purposes; for instance, for the use of jewelers, dentists, metal manufacturers, silversmiths, electro platers, polishers, foundries, cycle, automobile and sewing machine works, etc.

They are made of brass, steel and German silver wire; also of fiber, bristle, horsehair, yarn, cloth, felt, etc. The corrugated wire has been found to be more efficient than straight wire.

These "Mez" patent ring brushes are made in standard sizes and diameters, and it is a great advantage to the user to be able to purchase individual rings, as he need not keep a large stock of made-up brushes on hand, tying up an excessive amount of money for the purpose.

LACQUER ENAMEL, A NEW AIR BRUSH MATERIAL.

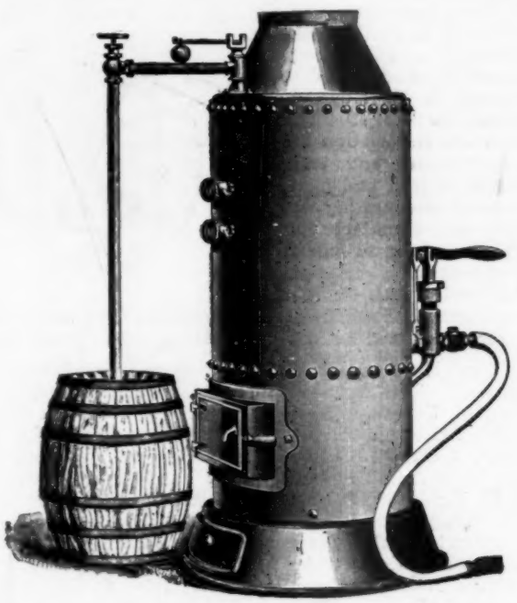
Manufacturers in hundreds of fields have felt the need of an enamel of better quality possessing properties not found in ordinary paints and varnish enamels, which will give a more beautiful as well as a more durable finish. The Eureka Pneumatic Spray Company, 276 Spring street, New York, claim that in their lacquer enamel they have a material that meets the wants of thousands where anything else will not satisfy. It is absolutely non-porous, hygienic, contains no oil, varnish or white lead and is, therefore, adapted for many grades of work where an absolutely sanitary finish is desired. On many articles it is superior to vitrified enamel for the reason that it will not crack and give lodgment for germs in the cracks. This makes it especially desirable for hospital and similar work. Bath room fixtures and seats properly covered with this material will withstand the acids and alkali to which this class of work is subjected. Water will not affect it, and, therefore, seats are indestructible, can be washed with soap and scoured with sapolio, without injuring, which would in a short time destroy the polish and plating on ordinary plumbing goods.

The architects of this country are enthusiastic over the beauty of the white, in particular, applied to chandeliers and furniture and interior finishing. Verd-antique finishes on metal goods can be quickly turned out without the labor of polishing or grinding the goods. All colors may be had. The materials as a rule dry without gloss. A gloss may be produced with a coat of transparent lacquer sprayed on top, or, by putting a sufficient body of enamel on an article, it may be buffed; presenting a finish exactly like porcelain, but much stronger and sanitary, one which will not craze or scratch, or peel off. The peculiar nature of this material, of which the base is lacquer, makes it impossible to apply it by old methods and it is imperative, therefore, that users of this material have the compressed air process for spraying it on with the air brush.

The Eureka Pneumatic Spray Company is prepared to make immediate delivery of this material from New York stock, as well as of compressors and tanks of all sizes, and a line of air brushes varying in capacity from two ounces to two gallons, suitable for every field of work and material. They will cheerfully answer all questions, arrange for finishing sample work as well as making demonstrations before prospective customers at their New York address.

AN ECONOMICAL HEATER FOR PLATING SOLUTIONS.

The "Little Giant" Heater, illustrated herewith, has been installed in a large number of plating establishments, where it is being very successfully used for heating plating solutions and for other similar purposes. This heater is manufactured by Godfrey, Keeler & Company, 70 Warren street, New York, who equip it with grate for use with coal or with burners for gas. The latter arrangement has been found particularly satisfactory



NEW HEATER FOR ELECTROPLATING SOLUTIONS.

as, after the flow of gas is properly regulated, the apparatus requires no attention.

The manufacturers state that the outfit complete can be installed at a very moderate expense and that it will soon save its cost in any plating room. The dimensions of the boiler are:

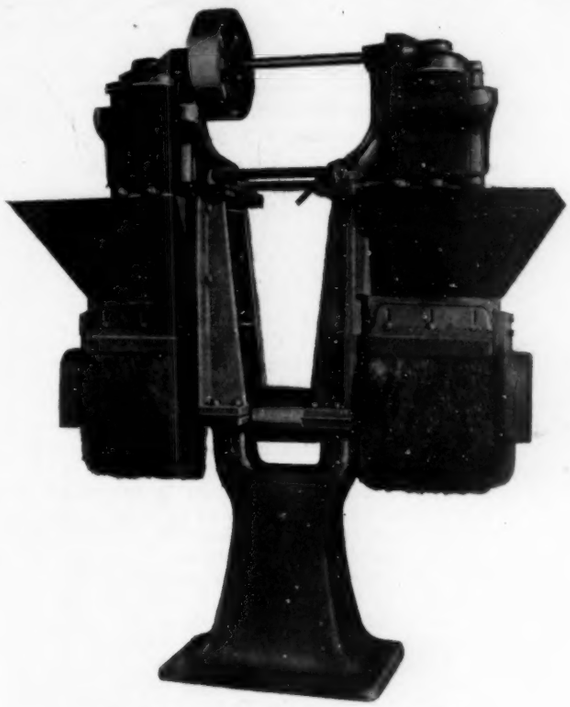
Diameter	20 ins.
Height	44 inches
Weight, complete with fittings	400 lbs.

The same company makes steam-jacketed kettles in capacities varying from 25 to 200 gallons, with inside diameters of from 22 to 44 ins., and weighing from 360 to 1,250 lbs., respectively. All these kettles are tested under 120 pounds steam pressure and are provided with all necessary fittings. Further particulars and prices may be obtained by writing to the manufacturers for their pamphlet "G."

BILZ SAND MIXER AND SIFTER.

In February, 1910, THE METAL INDUSTRY illustrated and described the Bilz sand mixing and sifting machine, which is designed on an entirely new principle, the mixing and sifting being done by means of a rapidly revolving cylindrical brush, to which the sand is fed through a hopper. The brush revolving under the hopper scrapes away the sand from the bottom, thoroughly sifts it and deposits it uniformly mixed in a heap beside the machine, while all foreign particles, such as nails, wire, wood, etc., are thrown in another pile. This machine has proved so successful that the builders have brought out an improved style made with double hoppers and brushes and having several times the capacity of the single hopper machine which was first put on the market.

The cut shows this new machine with the brushes mounted on each side of the pedestal, each brush surmounted by a hopper of the proper size. Instead of the sand being fed by hand, as in the old model, each hopper in the new machine is fitted with



AUTOMATIC SAND MIXER AND SIFTER.

three vertical worm screws which feed the sand down to the brushes automatically. These screws are driven by bevel gears which in turn are driven by power from the shaft.

With this automatic feeding device the capacity of the machine for mixing and sifting sand is increased to such an extent that the cost of doing the work is brought to an extremely low figure. All the labor necessary is that required to keep the hoppers full of sand. Every precaution is taken to make the machine as strong and durable as possible. All the gears and other working parts are boxed in so that dust cannot reach them.

The single hopper type has been used with great success by a number of prominent concerns, including The Mitchell & Vance Company, New York; Bureau Bros., Philadelphia, Pa.; Gorham Manufacturing Company, Providence, R. I.; Wm. Jackson, iron and bronze foundry, New York; A. Griffoul, Newark, N. J.; Joseph Reinbold, gold, silver and bronze foundry, Newark, N. J.; John Williams' Bronze Works, New York; Henry Bonnard Bronze Company, Mt. Vernon, N. Y.; George Himman, Inc., Plainfield, N. J.; General Electric Company, Pittsfield, Mass.

The first of the improved double hopper machines has been installed in the Singer Manufacturing Company's plant at Elizabethport, N. J.

These machines are manufactured by the Bilz Sand Mixing and Sifting Machine Company, 1314 Findlay avenue, New York. Descriptive circular "B M" will be sent upon request.

Associations and Societies

DIRECTORY OF AND REPORTS OF THE PROCEEDINGS OF THE METAL TRADES ORGANIZATIONS.

NATIONAL ELECTROPLATERS' ASSOCIATION OF THE UNITED STATES AND CANADA.

President, Charles H. Proctor, Arlington, N. J.; Treasurer, H. H. Reama, New York, N. Y.; Corresponding and Financial Secretary, Geo. B. Hogaboom; Recording Secretary, Royal S. Clark. All correspondence should be addressed to the Corresponding Secretary, Geo. B. Hogaboom, 656 Hunterdon St., Newark, N. J. The objects of the Association are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. Meets at Grand Opera House Building, 309 W. 23d St., on the fourth Friday of each month, 8 p. m.

The nineteenth regular meeting of the association was held Aug. 26, 1910, at the Grand Opera House Building, W. 23rd street, New York, with twenty-eight members present. H. H. Kleinberg, Charles Smalley, Albert Williams, Charles Peterson and Albert Vogel were elected to active membership. A communication was received from F. C. Clements, the vice-president from Pennsylvania, in which he stated that arrangements had been made to hold a meeting Saturday, Sept. 24, at 8 p. m. in Dooner's Hotel, 10th and Chestnut streets, Philadelphia, Pa. The purpose of this meeting is to organize a branch association, and he requested that as many of the New York and vicinity members as possible would make arrangements to attend the meeting. He would, upon being informed as to the time of arrival of anyone intending to attend, meet them at the depot.

A motion was passed that all members in arrears of dues who have been notified by the secretary of such delinquency and have not signified their intention of remitting, shall be considered members not in good standing in the association and would therefore forfeit the privileges of full membership. The question of a banquet to be held during the first week in February, 1911, was discussed, and a committee of three was appointed to look after the affair. Messrs. Hogaboom, (chairman), Hoffmann and Sliter compose this committee. The printing committee and the librarian were authorized to have five hundred copies of a pamphlet, to be known as the National Electroplaters' Association Quarterly, printed and used as advertising by distribution among prospective members.

Under the head of Good and Welfare of the Association the following papers were read and discussed: "The Production of Matt Gold Finish," by R. F. Clark; "The Roman Gold Finish," by C. A. Steihle, and "The Art of Producing Rose Gold Finish," by J. S. Stremel. Mr. Hering, of Terryville, Conn., presented the association with a very valuable book upon electroplating, written by Albert Smee, dated 1843. At the next meeting, Sept. 23, the discussion will be upon Verde Antique Finishes.

INSTITUTE OF METALS.

President, Sir Gerard Muntz, Bart.; Treasurer, Professor Turner, M. Sc.; Secretary, G. Shaw Scott. All correspondence should be addressed to the Secretary, G. Shaw Scott, M. Sc., Institute of Metals, Caxton House, Westminster, S. W., London, England. The objects of the Institute are for the educational welfare of the metal industry.

The Institute of Metals will hold its annual meeting in Glasgow on Sept. 21 and 22. Professor A. Barr, D.Sc., will act as chairman of the local committee, and Dr. Cecil H. Desch, D.Sc., Ph.D., as honorary secretary.

The following is a list of the papers that are expected to be submitted:

(1) G. D. Bengough, Esq., M.A., and O. F. Hudson, Esq., M.Sc., on "The Heat Treatment of Brass Experiments on 70:30 Alloy."

(2) Dr. Cecil H. Desch, D.Sc., Ph.D., on "Some Common Defects Occurring in Alloys."

(3) D. Ewen, Esq., M.Sc., on "Shrinkage of the Antimony-Lead Alloys, and of the Aluminum-Zinc Alloys During and After Solidification."

(4) F. Johnson, Esq., M.Sc., on "The Effect of Silver, Bismuth and Aluminum upon the Mechanical Properties of 'Tough-Pitch' Copper Containing Arsenic."

(5) H. S. Primrose, Esq., on "Metallography as an Adjunct to the Brass Founder."

(6) A. D. Ross, Esq., M.A., B.Sc., F.R.S.E., on "Magnetic Alloys Formed from Non-Magnetic Materials."

(7) Professor Longbottom and A. Campion, F.I.C., on "Heat Treatment and Properties of Gun Metal."

THE FOUNDRY AND MANUFACTURERS' SUPPLY ASSOCIATION.

President, Geo. R. Raynor, Niagara Falls, N. Y.; Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill.; Treasurer, J. S. McCormick, J. S. McCormick Co., Pittsburg, Pa. All correspondence should be addressed to the Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill. The objects of the Association are for the commercial and technical education of iron and metal industries by co-operating with all foundry and manufacturing interests in making an annual exhibit of supplies and equipments in conjunction with the meeting of the American Foundrymen's Association. The next exhibit and convention will be held in Pittsburgh, Pa., June, 1911.

Secretary Hoyt reports the following new members to the Association: The Adams Company, Dubuque, Ia.; American Combustion Company, New York, N. Y.; American Blower Company, Detroit, Mich.; Bayer Pattern Plate & Manufacturing Company, Cleveland, Ohio; Buckeye Products Company, Cincinnati, Ohio; Alfred Fisher, Chicago; The Foundry News, New York, N. Y.; High Pressure Sand Blast Company, New York, N. Y.; Ingersoll-Rand Company, New York, N. Y.; Michigan Smelting and Refining Company, Detroit, Mich.; Benj. Middleditch, Detroit, Mich.; Ohio Sand Company, Conneaut, Ohio; Pocahontas Coke Company, Cincinnati, Ohio; Q. M. S. Company, Plainfield, N. J.; Robinson Automatic Machine Company, Detroit, Mich.; Scrutari Trust, Montreal, Que.; Uranimite Company, Buffalo, N. Y.; David Williams (Iron Age), New York, N. Y.

Resignations.—Lane & Bodley Company, Cincinnati, Ohio; Manufacturers' Equipment Company, Chicago; Rathbone Molding Machine Company, Detroit, Mich.

He also announces that the following changes have taken place:

C. Drucklieb has transferred his business to J. M. Betton and same is being conducted at old address, New York, N. Y.

Arthur Koppel have changed their firm name to Orenstein-Arthur Koppel Company, Pittsburg and Chicago.

Wonham, Magor & Sanger have changed their firm name to Wonham, Magor & Bates, New York, N. Y.

OFFICIAL CHANGE.—John Hill, of Hill & Griffith Company, Cincinnati, Ohio, has been appointed vice-president to fill the vacancy occasioned by the resignation of Wm. Lodge.

GLAD TO SEE YOU!
WHAT IS THE NEWS IN THE METAL INDUSTRY?
PERSONALS
ITEMS OF INTEREST TO THE INDIVIDUAL.
THIS IS THE LATEST NEWS

CHARLES MILLER.

CHARLES MILLER.

Charles Miller, President of the Randolph - Clowes Company of Waterbury, Conn., the subject of this sketch, was born in Middletown, Conn., in 1839. He was the third eldest of the four celebrated Miller brothers of New England who, as told in the daily newspapers, have had such romantic and successful careers. It is related that each one of the four brothers was given seven hundred dollars by their father and told to start out by themselves and that each one of the Miller boys has become enormously wealthy and existing facts bear out the story.

Charles Miller drifted to Waterbury fifty years ago and went into the dry goods business, founding the firm of Miller & Peck, and from that small beginning he became one of the most substantial and successful business men of the town. In 1900 Mr. Miller had an opportunity to acquire an interest in a large seamless brass and copper tube plant in Waterbury and with his characteristic persistency he has since made good his first connection by gradually obtaining entire control. In connection with this business move it is related that other brass interests in Waterbury, somewhat resented the invasion of a field previously considered sacred only to those born and raised in it. Considerable opposition developed which quickly died down when it was seen that Charles Miller was in the brass business to stay, and he has since surprised everyone who did not know his quality, by his ready grasp of the details of a business at first so totally foreign to him. This plant is known as the Randolph-Clowes Company, and is a well established business for which he is reported to have refused large sums of money at various times. In addition to this establishment he owns large blocks of valuable real estate and is interested in many large industrial concerns.

Geo. W. Fleming, who is well known to THE METAL INDUSTRY readers as a writer on "Turret Lathe Practice," has resigned as Eastern sales manager of the Pittsburgh Gage and Supply Company, with headquarters in New York, and has become vice-president and general manager of the Behring Radiator Company at Ticonderoga, N. Y. The radiator works manufacture a sectional radiator which is in great demand by automobile manufacturers. In the manufacture of the radiators the company are large consumers of brass and copper sheet.

William Schwemmer, who has been connected with the J. K. Osborn Manufacturing Company, manufacturers of metal novelties, of Harrison, N. J., has been promoted to foreman of the plating department to take the place of August Hoffman, who recently severed his connection with that company.

Jeremiah Howe, who is well known throughout the brass and copper rolling industry of the United States, has returned from his five weeks' visit to Ireland and England, where he was accompanied by Mrs. Howe and his son Vincent A. Howe. On his return to America Mr. Howe first visited Connecticut and Massachusetts and then went to his present home in Buffalo. On Oct. 1 he will return to his former home at Detroit, Mich. In THE METAL INDUSTRY for June we published a portrait and sketch of Mr. Howe, in which we mentioned that for nearly forty years he has been connected with the brass and copper rolling mill business, and has been general manager and superintendent of a number of notable plants.

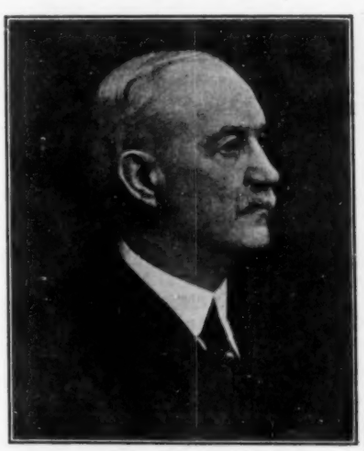
August G. Hoffman, foreman plater for the J. K. Osborne Manufacturing Company, manufacturers of metal novelties and plate specialties, of Harrison, N. J., has resigned his position to take full charge of the J. L. Marigold Electroplating Works, job platers in all kinds of electroplating and coloring, 97 Chestnut street, Newark, N. J.

Charles F. Kenworthy, the well-known furnace engineer, until recently with the engineering department of the American Brass Company, and formerly of the Kenworthy Engineering Company, Waterbury, Conn., has been engaged by the Rockwell Furnace Company to represent them in the United States and Canada.

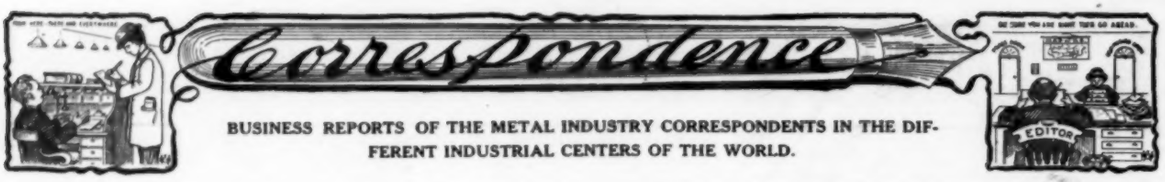
DEATHS

LUCIUS A. COLE.

Lucius A. Cole, President of the National Lead Company, died at Carlsbad on Aug. 26. Mr. Cole was born in Columbus, Ohio, sixty-three years ago and was educated in that city and Cincinnati. He came to New York from Parkersburg, W. Va., in 1890, and was elected the first treasurer of the National Lead Company at its organization in 1891. Holding this position for a few years, he was made vice-president, and in 1896 became president, which position he held at the time of his death. Mr. Cole was director in the Seaboard National Bank, the New Amsterdam Casualty Company, the Magnus Metal Company and the Assurance Company of America of New York. He was a member of the Lawyer's Club and Down Town Association of New York. Besides his wife, who before her marriage was Miss Emma Straub, of Cincinnati, three sons, George Campbell Cole, of St. Louis, Mo.; Walter F. Cole and M. Douglas Cole, of West Orange; three daughters, Mrs. Louis Wallmer, of Chatham; Mrs. Percy Waram, of New York, and Miss Frances Cole of West Orange, and two grandchildren survive.



LUICIUS A. COLE.



BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS IN THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

SEPT. 6, 1910.

With the reopening after the three days' holiday recess for Labor Day, the factories in this city will begin what promises to be one of the busiest fall seasons in years. With holiday orders coming in well the novelty shops have been busy for weeks, and there has been no let-up in any line since July, but rather a steady sure recovery from the annual easing up of business due in the early summer. In some factories it has already been necessary to resume night work for from two to five hours overtime.

One of the busiest concerns for the past six weeks has been the Blake & Johnson Manufacturing Company, which has been working on a motor for automobiles that seems full of promise. It has recently completed its first lot and has a goodly number of orders ahead, requiring 100 to 200 hands to work overtime two and three nights a week during the past month.

Another busy plant has been the infant watch factory of the Bannatyne Watch Company, in which the Farrels of Ansonia have a large interest. This concern is putting out another new model in the watch line with improvements that are entirely new to watches of the $1.50 grade, and has won the confidence of the trade to the extent of large orders already. By the first of October the new model will be well circulated throughout the country, and is expected to make another record for this company's enterprise under the management of Mr. Bannatyne. The shop is not quite three years old yet.

Not losing sight of competition, the Waterbury Clock Company, manufacturers of the Ingersoll product, has also developed a new model recently, and it is to be included in its new catalogues. The plant is as busy as ever, and is largely kept so by the wonderful success of the cheap watch in foreign as well as domestic markets. The exploitation of the watches of this concern in Europe is understood to have been fully as successful as expected. Now that the Bannatyne concern is advertising extensively and seemingly finding a ready market for its product, the competition between these two leaders in the watch field promises good returns to both by virtue of the added prestige of the product. Men of all circumstances are now numbered among the consumers of the "2-year-guarantee" timepieces. In the New England Watch Company's plant also there is much activity, and as this concern will probably resume its case making on a large scale again in the near future, the outlook is still more promising. The employees of this concern, following the donation of the use of a large portion of the shop grounds for a public playground for children by the company, erected a large tent by subscription and has otherwise won the friendship and gratitude of the children and benevolent workers by their generosity towards the "kids" who play in the shop's vicinity.

In the pin factories there seems to be little cessation of the remarkable demand for these common products, and the orders now are understood to be practically as large and the payments as prompt as in the busy days before the memorable 1907 panic. In several departments the hands have been kept working until 9 p. m. during the past six weeks, and there will be an increase in speed as fall approaches.

In the rolling mills work is brisk. With the normal number of hands, occasionally pushed to overtime, the mills are kept on the jump with orders, and the past month has been the busiest August in years; so busy, in fact, that vacations have been curtailed. Chase's the Benedict & Burnham plant (American Brass Company) and the Waterbury Rolling Mills have been affected similarly.

In the various hardware lines, casting, and machine shops, the conditions are fully assuring from the optimistic's point of view, and Plume & Atwood, The Farrel Foundry & Machine Company, the Randolph & Clowes Company, and the various departments of the Scovill Manufacturing Company under this head are busy and prepared for more. There is no great demand for employees or new help, but all are running with their full complement of help and there has been little laying off all summer. Whenever there has been a slump in these shops of late the men have quickly been made busy on repairs and improvements, and in those plants where extensions or additions have been erected during the past two years equipment has been rushed into place and made ready for use. In Scovill's, where the payroll now includes upwards of 4,500 men and women, a new addition is soon to come in which there will be accommodations for a force of 500 more, making the total number of employees larger than in any other concern hereabouts, and one of the largest in the world.

The Scovill company has recently reclaimed and graded a large piece of land bordering on the Mad River, extending to the east of its plant for hundreds of yards, and an excellent site for additional buildings in its present condition, as the Cheshire branch of the New Haven Railroad runs through it and affords splendid facilities for shipping. The company has met with some opposition from residents of Hamilton avenue, as it plans to run a spur track at grade across that thoroughfare to the newly made land, and the matter is now before the State railroad commissioners and the city.

In the suburban towns prosperity seems well rooted and the outlook promising. The Seth Thomas Watch Company, of Thomaston, is busy and will be forced to higher speed throughout the next three months, partly on late holiday orders. The Plume & Atwood branch in Thomaston is also running steadily and with increasing demand for products. In Torrington the Coe Brass Company's plant is working full time again, the Summer schedule concluding with the Labor Day shutdown, and in the lower Naugatuck Valley towns similar conditions prevail.

Bridgeport, the city of numerous small metal industries, as shown in an article* in THE METAL INDUSTRY last winter, is quite proud of its census record, putting it in the second place among Connecticut cities, and its industries are just as proud as its citizens. These are the real cause of Bridgeport's rapid climb in population and the foundation of Bridgeport's industrial prosperity in recent years. In our report last month we referred to the trouble the Whiting Metal Company had when it first came to Bridgeport in bringing with it from New York some its old help. We did not mean to have it inferred that the company were unable to properly run its Bridgeport plant, or even felt the loss of such men keenly, although a number who were counted on to make up the pioneer force in the new plant did not stay. The case was cited simply to show the difficulty firms encounter when removing from place to place, or starting new branches some distance from the home factory in keeping old hands with them. And it was further intended as evidence of the foolishness of "croaking" in New York when mechanics are all busy and get employment easily, even if the retailers do find the demand for their wares light.

It was recently rumored that Charles Miller had been offered a million or thereabouts for his interest in the Randolph-Clowes Company. Mr. Miller promptly denied that there was even a figment of truth in this report. While his rapid rise from the possessor of a heritage of $700 to millionaire by his own efforts and business acumen has been told and retold many times of late, he is not just ready to quit, although his activities may seem a little less pronounced than in the past.

In the course of a few days an interesting experiment will be put into practise in the Kalbfleisch Chemical Company's plant. On account of disagreeable acid fumes, causing complaint among residents in the vicinity of that factory, the company has sought long for some plan to remedy the evil, and in co-operation with the health authorities, it has arranged for the installation of acid

*February, 1910.

chambers, which are expected to nullify the injurious elements of these fumes and vapors floating from the chimneys. The installation of these chambers is to be completed early this month.—F. B. F.

PROVIDENCE, R. I.

SEPT. 6, 1910.

In all lines of metal business there is an air of expectancy and activity that augurs well for the fall and winter industrial prospects. This is especially pertinent concerning the manufacturing jewelry interests and its numerous kindred and subordinate lines. At present the orders for the fall and holiday trade are small, though numerous, but the aggregate is sufficient to cause repeated advertisements in the local dailies for help of all kinds wanted. One of the striking indications of a good outlook is the fact that of the jewelry that is in most demand, it is not the cheaper class. This, of course, is usually the case a month or six weeks later as the holidays approach, but to have it so pronounced at the opening of the season is somewhat unusual, and is royally welcomed by those engaged in that grade of work.

While the manufacturing jewelry plants, that is, those coming strictly under that head, are opening the season on full schedule of time, the mesh bag industry demonstrates that the people of the country have gone mesh bag wild. Scores of Providence and Attleboro concerns that have taken up the production of these goods find themselves completely swamped. They are unable to keep up with the demand. Throughout the entire New England sections are thousands of women—young and old—who, in their homes are making or rather linking up these bags and purses, and still the manufacturers are unable to meet the demands of the trade.

The advent of the automobile has been said in many quarters to be a detriment to general business, in that people invest in one of these machines who cannot afford or are unable to support them. Be this as it may, one thing is certain, the brass workers and finishers, as well as the nickel plating men of this city, were never so busy as at present, and mostly on automobile parts. Lacquerers also report plenty to do, largely on similar work. Silversmiths have plenty to do, and at the Gorham Manufacturing Company's plant, in several of the departments they have months' work ahead. This is especially pertinent to the bronze foundry, where orders for large pieces have accumulated, and the department is on rush hours to get out the handsome statues and ornamentations.

The Art Metal Manufacturing Company's plant at 80 Clifford street, of which George H. Chandler was the principal owner, has been purchased by John M. Howard, who will continue the manufacturing of the goods made by that concern.

Fred E. Newell, of Newell's Brass Foundry, Central Falls, was the host of the employees of his brass foundry and finishing shop early in the month on the occasion of the annual three days' outing at his summer home in Oak Bluffs on Martha's Vineyard.

Equipped with three gallons of muriatic acid, a man suspected to be a former employee, destroyed 1,500 gallons of nickel, 100 gallons of copper and 100 gallons of brass solution in the Rhode Island Nickel Plating Works, 33 Garne street, a few nights ago. The loss is estimated at $500. When one of the employees reached the shop in the morning he found that the place had been entered during the night. A rear window had been forced open and the premises looked as though they had been ransacked from top to bottom. After a short investigation the man discovered muriatic acid had been poured in the solutions mentioned. The police are investigating the affair.

During the past month the manufacturing jewelry firm of William C. Greene & Co., of this city, was sold by the receiver, John A. Straight, to interests represented by Edgar C. Doherty. There is to be a reorganization of the business. It went into the hands of a receiver about two years ago upon the petition of John A. Straight, of the refining firm of Straight & Conley.

One hundred and twenty-five members of the New England Foundrymen's Association made a trip down the Bay the past month to Field's Point, where a business meeting was held and a shore dinner enjoyed. The sail was taken on the tug Sarah McWilliams, which was placed at the disposal of the association by the James McWilliams Blue Line of New York, a concern which owns most of the barges in which molding sand is towed from the landing ports up the Hudson to this city.

An involuntary petition in bankruptcy has been filed against Leary & Penfold, manufacturing jewelers, and Robert Grieve was appointed receiver.—W. H. M.

NEWARK, N. J.

SEPT. 6, 1910.

The manufacturing jewelry business has been rather quiet for the past two years. During this period of depression, as this city is the largest center in the country for high grade jewelry, 14 karat and better, this is the line that has been hit the hardest. While also a good deal of the 8, 10 and 12 karat goods is made here, the main center for the cheaper grades is in Providence and the Attleboros. This market has been hit the hardest as the higher class of goods have been neglected. The large increase in the cost of living and business conditions not of the best, has resulted in an increased demand for the cheaper grades. Many of the firms which have been making only 14 karat and better gold goods have now made arrangements to make the cheaper grades as well. Some have organized a separate company, preferring not to let the general public know that they are making the cheaper lines, others are doing so openly.

The Premo Manufacturing Company, who make brass, bronze and aluminum novelties, have moved to a new factory building at 120 Pacific street. New machinery has been installed, have put in a polishing and plating department, have put on more help and expect to considerably increase this output. They moved from 10 Lum street.

Hanson & Van Winkle, manufacturers and wholesale dealers in polishing materials and supplies have a far better plant and facilities, in the new location, having moved from Market street to Chestnut and Malvern streets. A new building has been erected having the most complete facilities for the making of their lines, and another building has been lately erected on Malvern street, which will have a demonstrating room for machinery models. A small dynamo is being made, which is a new thing, particularly for the manufacturing jewelry business.

The Blume Manufacturing Company, who make ormolu gold clocks and metal novelties, 471 Washington street, have done a very good business in novelties and clocks, having moved here a year ago from Passaic, N. J. They have made a three years' contract for their entire output, with D. Volkoff, a New York jobber on Canal street.

William C. Fink has sold his silver novelty factory at 115 Orchard street, Elizabeth, and has invented a process of eliminating fire in silver and copper and green in gold. No dipping or stripping is necessary and the metal can be reheated and it will not return. The fineness of the metal is not changed as the removal of the impurities makes it ductile. More work can be obtained from a certain number of blanks, the metal will roll with less annealing, and in stamping or drawing, the work will show great improvement. Mr. Fink is now acting as an expert to the trade in improving the output, methods, machinery, processes, etc.

Theodore C. Metz started not long ago in the manufacturing jewelry business at 8 Johnson street, and was formerly with Metz Bros. Every man he has is an artist in his way and an expert, only work of the finest grades being turned out, such as 14 and 18 karat gold and platinum. The output is not gauged by the quantity of the work, but the quality. Most of the work is specially to order and he makes none known as "stock goods." Every piece turned out is original, unique and is never duplicated. A new line of machinery has been put in.

The Elm Manufacturing Company, 391 Mulberry street, has been in financial difficulty for the past six months. Robert C. Dick, who fought the business and incorporated it, found a lot of old bad debts against the firm which he is trying to straighten out. A settlement was offered of 25 per cent., but was not accepted by all the creditors. The plant was up for sale several times but was postponed. They have a good plant and have dies and machinery for the making of brooches, stick pins, crosses, lockets, bracelets, etc., which gave them an advantage over many other firms. The assets are $26,000 and liabilities $15,000. Frederick J. Meelander, who used to own the business,

died last week. It is expected a settlement will be made or the plant sold out shortly.

John B. Wolff, who used to be in the refining and smelting business at 8 Elm street, organized a company known as the Wolff-Trautz Company, with a capital of $50,000. A building was erected for the plant at 9 Delancey street and the business has been enlarged. Later the plant will be added to. Charles Trautz was with the Boston-Colorado Smelting Works of Argo, Colo., he will tend to the outside work and Mr. Wolff the manager inside.

The Long O. Kosch Company, manufacturing jewelers, are building a new building for their plant at 126 South street. They will occupy two floors and will lease out to others two floors. The plant will be equipped with the most up-to-date machinery and will increase the output.—H. S.

CLEVELAND, OHIO

SEPT. 6, 1910.

With the approach of fall the business outlook among the metal manufacturing companies in this city looks quite promising. The automobile business is not going at quite so fast a clip as for the past year or fifteen months, but Cleveland makers of the machines say they are satisfied with the volume of business which is coming their way. The molding shops and plating establishments are all busy for considerable stock is being laid up during intervals when the shipping room is not busy.

The demand for plumbing fixtures of all kinds continues very brisk and shows no sign of letting up as the fall season advances. The various big factories here engaged in this line of work are all running full time and report plenty of business in sight. The aluminum foundries are also very busy with aluminum auto castings and other stock. Big downtown storekeepers who handle aluminum utensils of all kinds are telling their customers that there should be a reduction in the price of these goods when the aluminum patents run out. If there is there will be an extraordinarily heavy sale of them, for these goods are exceedingly popular.

Many of the big novelty dealers and department stores are handling large quantities of brass and copper ornaments, both beaten and spun. They say the field for this line of work is practically unlimited and is expanding greatly every year. The durability of these goods offsets, in the minds of many customers, the extra initial cost involved.

Another big brass manufacturing company has been launched in northern Ohio. A concern known as the F. W. Wakefield Brass Company has been incorporated at Columbus by Fred W. Wakefield and others of Vermillion with a capitalization of $100,000. Its main business will be conducted from that place.

Another incorporation of considerable interest occurred during the month, when the Webb C. Ball Company was incorporated to take over the retail business of the Webb C. Ball Watch Company. The new corporation will take charge of the palatial new store to be opend this month in the Kingmore building on Euclid avenue, east of East Ninth street. The work of remodeling the building has been in progress for some months, and it is about ready for occupancy. The store at West Third street and Superior avenue, which has for years been the head of the retail and manufacturing business of the Webb C. Ball Watch Company, will then be used exclusiveley for the watch manufacturing business, which turns out high grade watches for a number of big railroad systems in the Middle West. The capital of the company is being increased from $10,000 to $500,000. George B. Adams, who came from New York about a year ago, will have charge of the new store, which will be one of the finest in the country.

A $35,000 building permit has been taken out for the erection of a handsome new warehouse for the W. S. Tyler Company, manufacturers of ornamental brass, bronze and iron goods.

Nearly $100,000 is to be spent this fall in remodeling the big banking structure now in use by the Society for Savings, which is said to have the second largest number of savings depositors of any bank in the country. D. H. Burnham, an architect of Chicago, has awarded a contract for a large quantity of ornamental bronze work to the W. S. Tyler Company, and for a number of fine new lighting fixtures of brass and bronze to Willy Lau, of Chicago.

The White Sewing Machine Company expects to get into its fine new factory at St. Clair avenue and East 79th street within the next month, when the company's capacity will be more than doubled.—S. L. M.

PHILADELPHIA, PA.

SEPT. 6, 1910.

Trade in Philadelphia relies so much upon the tariff that anything and everything affecting National politics is a matter of prompt and serious concern here. The recent utterances of Colonel Roosevelt and the political capital made of them by his opponents have had a distinctly disturbing influence in every line of industry in Philadelphia and there is growing fear in financial circles that any definite move leading to more aggressive tariff agitation or other radical legislation will result in a commercial set-back of grave proportions. Colonel Roosevelt is extremely popular here but the same cannot be said of his disturbing speeches. The metal trade as well as every other industry dependent upon the tariff has been made to feel the quick result of Colonel Roosevelt's agitation and as the city is only emerging from more than two years of acute depression there is a growing tendency to wish that the Colonel had continued his stay in Africa.

Word has been received here that the Lalance and Grosjean tin plate mills at Harrisburg are to resume on Sept. 19 giving employment to 350 men.

Every branch of the metal industry was represented at the funeral of Andrew J. Hamilton, formerly active in the National Tube Company and the Morris & Tasker Company.—C. H. C.

DETROIT, MICH.

SEPT. 6, 1910.

Reports from different brass establishments in Detroit and the State show that business has not been so brisk during the month of August, but this is natural, and was expected by all the leading manufacturers. At the present time, however, conditions are improving, and the outlook is good for an even better period than that of a year ago.

The automobile plants in Detroit and Flint, Mich., have been running light for the past several weeks, but are now taking on men again, and within a short time will be operating heavily as before. The slowness in this business was expected, and has given the concerns a chance to take inventory and prepare for the heavy work of the season. There is no question about the boom continuing in the automobile industry throughout the winter and the following summer. Many of the plants already have orders sufficient to keep them going until long into next summer.

Improvements have been made in all the large automobile plants during the last few months, and when operations are in full blast the facilities for handling a great amount of work will be appreciated.

Manufacturers and residents of Detroit are elated at present over the great showing in the increase of population, as the result of the automobile industry and the subsidiary concerns, such as brass and aluminum factories. The population of the city, according to the census bureau, is over 456,000, which is 42,000 more than the city of Buffalo. There is no question that this growth is the result of the many manufacturing establishments that have come into the city within the last ten years. These industries have been largely automobile and brass. They have brought thousands of persons here, and are giving them constant employment. This work is steady, the employees are building homes, and are now permanent residents. It is the general prediction that if the present growth continues, Detroit will crowd the one million mark before the next ten years pass.

The general brass manufacturing business has been quiet during the last few months. Outside the manufacture of automobile parts there has been a comparatively slow summer. It is expected, however, that conditions will improve and the winter see a great change in this line. There is no question regarding the manufacture of automobile parts. All brass factories obtain plenty of this work, and while business may be dull in other lines, it is easy to keep plants in operation on automobile work. The Buick automobile factory has resumed operations at Flint, Mich., after a shut-down for a few weeks to permit the making of repairs and the taking of inventory. Several thousand men now being at work, and others will be added as the season advances.—F. J. H.

TRADE NEWS

TRADE NEWS OF INTEREST DESIRED FROM ALL OF OUR READERS. ADDRESS THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK

Additional Trade News will be found under "Correspondence."

The Kokomo Brass Works, Kokomo, Ind., are planning to build a one-story foundry building, 75 x 100 ft., early this fall.

The new extensions and improvements which the Baltimore Copper Smelting and Rolling Company, Baltimore, Md., consider making to their plant will increase its capacity about 25 per cent.

The A. P. Smith Manufacturing Company, manufacturers of tapping machines, valves, fittings, and also general supplies, Newark, N. J., are now occupying their new plant at Watsessing, N. J., on the D., L. & W. R. R.

The Northern Engineering Works, Detroit, Michigan, recently installed a No. 36 Newten cupola in the new foundry of the Packard Motor Car Company, Detroit, and a No. 60 Newten cupola in the Ford Motor Company's foundry.

The Naugatuck Chemical Company, Naugatuck, Conn., announces the termination of its selling arrangement with the Charles E. Sholes Company and the organization of its own sales department, under the management of H. Stuart Hotchkiss.

The Cream City Smelting Company, Milwaukee, Wis., owned by Martin Zwoster, now occupies its own new cement block building on National avenue. The plant is electrically driven. All the old equipment has been overhauled and some new machinery added.

Schwartz & Land, 357 Pearl street, New York, advise us that they are buyers of all grades of copper bearing material, including all kinds of drosses and skimmings. This firm also makes a specialty of buying and selling second hand motors, dynamos and machinery.

The A. H. Coplan Company, of Ottawa, Limited, manufacturers of Babbitt metal and solder, who recently were incorporated for $60,000, are erecting a fine four-story building in which to carry on their business. This company will also install a smelting and refining plant.

The Naugatuck Manufacturing Company, manufacturers of seamless copper floats, Naugatuck, Conn., are erecting an addition to their factory which will be devoted to the copper depositing department. Increased business is the reason for the additional manufacturing space.

W. T. Annis, West Second street, Dunkirk, N. Y., is building a brass foundry which is constructed of concrete, 30 x 31 ft., and will handle crucible metals. Mr. Annis will also have a pattern shop, and in the near future will install a complete outfit for electroplating operations.

The Techno-Chemical Company, of Cleveland, Ohio, have changed their name to the Cleveland Tensilite Company, with offices at 1413 Brownell Court, Cleveland, Ohio. The company are manufacturers of "Tensilite," an assimilator and purifier for all ferrous and non-ferrous metals.

Dings Electro-Magnetic Separator Company, Milwaukee, Wis., has just turned out an unusually large magnetic separator. The machine weighed 10,200 pounds, and was guaranteed to handle 120 tons of coal per hour and remove all "tramp" iron, from nails up to pieces of scrap weighing fifty pounds.

The Caldwell Manufacturing Company, manufacturers of hardware specialties, 8 Jones street, Rochester, N. Y., are equipping a small plating plant in their factory. The officers of the company are W. H. Caldwell, president and treasurer; Emil Kuighling, vice-president; F. C. Caldwell, secretary.

The Phoenix Plating Works, Grand Rapids, Mich., will install two nickel tanks, four polishing machines, a new motor and a new polishing dynamo in the building adjoining its present works, recently vacated by the Michigan Tool and Stamping Works. This building contains 2,000 feet of floor space.

In order to better serve its many customers throughout the South, the International Acheson Graphite Company has opened a Southern branch in Atlanta, Ga. It is understood the company is very pleased with the appreciation shown for its lubricants—Gredag, Oildag, Aquadag, and its pure powdered graphite—by Southern industries.

The Haas Bros. Company, 601 Union Building, Newark, N. J., manufacturers of specialties for cleansing and polishing metals, state that by using their hascoline chips in the mechanical burnishing process with tumbling barrels and steel balls that much better results are obtained than by the use of any kind of soap or other burnishing material.

The Milwaukee Aluminum & Brass Foundry Company, Milwaukee, Wis., has been developed from a very modest beginning, until it now owns and occupies its own new brick structure with modern equipment. The business has been under the direct management of Messrs. Charles Boltz and James McCracken. These gentlemen have recently purchased and retired all outside interests in this company, and they are now exclusive owners of the business.

The published reports that the Western Brass Works was organized at Tacoma, Wash., to continue the business of the Lewis Brothers on a larger scale, is now said to be untrue, and that there is no such firm as the Western Brass Works in existence in Tacoma, and at the present writing there seems to be no likelihood of the establishing of a brass works. The I. & B. Brass Foundry Company of Tacoma is now the largest brass works in operation at that place.

William J. A. Bailey, who recently returned from a successful trip around the world representing a number of American manufacturers, is now preparing another business tour. He expects to leave this country early in the fall, and will be gone about a year, visiting the leading commercial centers of the world. Mr. Bailey markets his lines in conjunction with permanent sales offices in the different countries so that this trip would no doubt be of interest to manufacturers seeking foreign trade. His address is 32 Broadway, New York City.

Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock a. m., Sept. 20, 1910, and publicly opened immediately thereafter, to furnish at the navy yard, Puget Sound, Wash., a quantity of naval supplies, as follows: Sch. 2840: Liquid metal polish. Sch. 2841: Rolled naval brass, asbestos felting, asbestos plaster, fire brick. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office, Seattle, Wash., or to the Bureau. T. J. Cowie, Paymaster-General, U. S. N.

Owing to a disagreement which developed among the stockholders of the Flexible Abrasive Wheel Company, Newark, N. J., it has been found advisable to stop manufacturing operations temporarily until a satisfactory agreement is reached between the dissenting parties. This company recently advertised their new flexible emery wheel for polishing metals, and secured a large number of orders, some of which have not been filled for the reason mentioned above. At a recent interview a representa-

tive of the company stated that it would probably be only a very short time before the points at issue are settled and active operations resumed.

Beaupre Brothers, of Franklin Falls, N. H., proprietors of a brass and aluminum foundry on Webster street, report that they have outgrown their present quarters, and are obliged to move from their present plant. A new site was recently purchased by the firm, and is now rapidly being put into shape for occupancy. The foundry will be equipped with new machinery throughout, and the firm expect to move into the new location in November. At the present time twenty-two men are employed, but this number will be greatly increased when business is begun at the new plant. The output of this firm consists of all kinds of castings, either brass, copper, bronze, aluminum or iron.

H. M. Shimer & Co., Nineteenth street and Washington avenue, Philadelphia, Pa., announce that they have a patented process for melting and refining aluminum turnings, and that they will take these turnings, subject to a sample, refine them into ingot at a price agreed upon per pound, and will guarantee an agreed upon loss. They announce that they are already melting and refining with good results the turnings of several large concerns. Their method is to first run the turnings through a separator, then put through a furnace. Besides being melters of aluminum turnings, H. M. Shimer & Co. are also manufacturers of the "Golden Rod Brand" of spelter, brazing solder, phosphor bronze red and yellow brass ingots, etc.

The Howell-Melville Company announce the opening of an establishment at 1223-1225 Spring street, Philadelphia, Pa., for the manufacture of high-class house and marine plumbing specialties, brass railings and special metal work for shipyards, railroads, factories, chemical works, paper mills, hospitals, etc. They will also conduct a general electroplating business, including bronzing and oxidizing, and will give prompt attention to repair work in the above named lines. The officers of the new company are: George B. Howell, president; James N. Melville, secretary, and Will B. Hadley, treasurer. Messrs. Howell and Melville were formerly connected with the old firm of McCambridge & Co. of Philadelphia, manufacturers and jobbers in plumbing supplies.

The Bayonne Casting Company, Bayonne, N. J., who are distributors of monel metal in rods and castings, are now operating full handed at their recently equipped plant. The company has recently contracted for four monel metal propellers for the United States battleship Florida. These propellers are to be 10 ft. 6 ins. in diameter and weigh about 8,000 pounds each. Another considerable contract just entered into calls for twelve propellers for the large battleships being constructed for the Argentine Republic by the Fall River Shipbuilding Company and the New York Shipbuilding Company. These propellers are cast of monel metal in one piece, and are about 15 ft. 6 ins. in diameter, and weigh 16,000 pounds apiece. As has been noted before in THE METAL INDUSTRY, the plant of the Bayonne Casting Company has only lately been completed at a cost of $75,000. The present capacity of the melting room is 40,000 pounds of monel metal daily. The officers of this concern are W. T. Edwards, president, and Robert T. Stanley, treasurer.

Lewis Thompson & Company, Inc., 18th and Indiana avenue, Philadelphia, Pa., announce that their trade in mahogany pattern lumber is growing rapidly. Many of the most prominent makers of castings now use Thompson's special grade mahogany almost exclusively instead of white pine for patterns, the cost being no higher. Among their customers are the General Electric Company, of Schenectady, N. Y., and its branches in Pittsfield, Mass., and Erie, Pa.; Westinghouse Machine Company, Westinghouse Electric Company, Westinghouse Air Brake Company; Allis-Chalmers Company, of West Allis, Wis.; Bullock Electric Company, of Norwood, Ohio; Pratt Engineering and Machine Company, of Atlanta, Ga.; Southern Iron and Equipment Company, of Atlanta, Ga.; Ingersoll-Rand Company, of Phillipsburg, N. J., and the American Locomotive Company, of Schenectady, N. Y., and its various branches. Lewis Thompson & Company control large mahogany forests in Mexico and maintain immense distributing yards at Philadelphia, Pa., and at Astoria (L. I.) N. Y.

The Hawley Down Draft Furnace Company, Chicago, Ill., have had in operation for the last seven or eight years a number of Schwartz furnaces for making steel castings, notably in the foundries of the Pettibone-Mulliken Company and the Otis Elevator Company of Chicago, who have given repeat orders for furnaces. The Hawley people are now turning their attention more especially to such brass and iron foundries as have use for a small amount of steel castings at various times. Where a certain amount of steel castings are required, but where quantity is hardly large enough to warrant the installation a regular steel plant of the usual kind and in cases where large steel manufacturers desire a furnace for the making of special steels in small quantities, the furnace will no doubt meet with great success. The Hawley Company claims that a user of their steel furnace can deliver a casting within three hours after the pattern is received. They also claim great economy in time, floor space, and labor, guaranteeing satisfaction. They are, in fact, placing a number of furnaces out on specific guarantees if so requested. This furnace is being built in sizes of from two to eight tons per heat. The largest furnace heretofore built by them, that is, until two years ago, has been five tons capacity.

REMOVALS

Proctor & Stremel, consulting platers, have moved from 621 Chestnut street to 370 Argyle Place, Arlington, N. J.

The Miller Saw-Trimmer Company removed Sept. 1 into their new plant, which has been built especially for them at Alam, Michigan. This company manufacture the Miller saw trimmer, which is claimed to be the only machine that saws and trims with a single operation.

BUSINESS TROUBLES

A petition in bankruptcy has been filed by the creditors of Hirsch & Son, trading as the Imperial Cutlery Works, of Newark, N. J.

A. H. Skillin has been appointed receiver of the Zucker & Levett & Loeb Company, the well-known platers' supply house of New York City. The business will be continued as usual by the receiver, pending further action to be taken by the creditors at a meeting that is to be called for next week.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Correspondence" columns.

STANDARD BRASS FOUNDRY, Indianapolis, Ind. Capital stock, $10,000. Directors: Herman Lifchitz, Albert Holzworth and Louis Saga, all of Indianapolis.

BLACK ROCK BRASS AND BRONZE COMPANY, Buffalo, N. Y. Capital stock, $5,000. Directors, Sherman D. Enoch, Owen B. Augspurger and George A. Orr, all of Buffalo.

THE AMERICAN ART METAL AND LAMP COMPANY, Dayton, O. —Capital, $25,000. To make fancy metal goods, such as pounded brassware, etc. Incorporators: J. E. Potts, F. W. Davis, W. F. Dill, A. K. Rieger and A. W. Shulman, all of Dayton.

ELIAS PUTTERMAN COMPANY, New York. Capital, $18,000. To manufacture articles of brass and other metals and alloys. Incorporators: Elias Putterman, 118 Eldridge street; Samuel Putterman, 297 Broome street; Lewis Morse, 850 E. 161st street, all of New York City.

LEWIS-ROTH COMPANY, Philadelphia, Pa. Capital stock not set out in preliminary application. To deal as principals and agents in copper wire, electrical and mechanical apparatus of all kinds. Incorporators: Lima R. Lewis, Raymond T. Roth, and William E. S. Dyer, all of Philadelphia.

INCREASE OF CAPITAL STOCK

The Wolverine Brass Works, Grand Rapids, Mich., have increased their capital stock from $400,000 to $500,000.

The McRae & Roberts Company, brass founders, Fort street, West Detroit, Mich., have filed notice with the county clerk of an increase in capital from $195,000 to $395,000.

PRINTED MATTER

GLUE AND GLUE MAKING MACHINERY.—The Advance Machinery Company, Toledo, O., issue a 64-page catalogue giving full descriptions of the operations of Advance and Wetmore patented glue making machinery. The book is extremely well arranged and gives a good deal of valuable information regarding the preparation and use of glue.

ANTIMONY.—The C. W. Leavitt Company, New York, send out a folder advocating the use of the A. S. E. Brand English Star antimony for the preparation of babbitt into brittania, electrotype, linotype and all their mixtures in which antimony is used. This antimony is guaranteed by analysis to be 99.58 per cent. pure. Prices and other data upon request.

BUSHING PATTERNS.—The Lumen Bearing Company, Buffalo, N. Y., announce that they have a stock of standard bushing patterns which are kept on hand at all times, and anyone needing bushings quickly may be able to obtain the same from this company. The list of such patterns is contained in a small booklet, the fifth of the series, which has been issued by this company, and will be sent upon request.

RESISTANCE MATERIALS.—The Electrical Alloy Company, Morristown, N. J., publish a neat little booklet of sixty pages giving information regarding their various forms of materials used for the manufacture of apparatus and instruments requiring electrical resistance. This company make a specialty of resistance materials in wire, sheet and ribbon form, and also produce nickel-steel, nickel-copper, ferro-copper, nickel-chromium, German silver and manganum alloys. Parties writing for this catalogue should specify Catalogue "A."

SEAMLESS TUBING.—The Elwood-Ivins Tube Works, Oaklane Station, Philadelphia, Pa., have issued a circular and price list of their cold drawn tubing. Among various descriptions of tubing manufactured by this company are seamless steel, brass, copper and aluminum tubing, which is produced in any size that may be required with an accuracy of gage to within one one-thousandth of an inch. The tubes manufactured by this company are used as a standard or measure of quality by the United States Government. Further particulars may be obtained by corresponding with the company.

NEW BURNISHING PROCESS.—The Abbott Ball Company, of Hartford, Conn., are issuing a neat booklet, "A. B. C.," relating to their new burnishing process, which they say is the quicker, cheaper and better way of polishing small metal articles. Mr. George E. Abbott of the Abbott Ball Company, is the designer of the Abbott tumbling barrel, now manufactured by the Globe Machine and Stamping Company of Cleveland, O., and known as the "Globe-Abbott Barrel," the Abbott Company having sold to them the rights, they confining themselves to the manufacture of steel balls for polishing and burnishing purposes. The ball process and the barrel and compound for use with the balls has been illustrated and described in THE METAL INDUSTRY and are at present advertised in our journal, and further particulars may be obtained by referring to our advertising pages and by sending for circular "Globe," issued by the Globe Machine and Stamping Company, Cleveland, O.; Booklet 'A. B. C.," issued by the Abbott Ball Company, Hartford, Conn., and the information sent out by the Haas Brothers Company, Newark, N. J., the respective manufacturers of barrel, balls and the burnishing compound.

AD NEWS

Lewis Thompson & Company, Inc., 18th and Indiana avenues, Philadelphia, Pa., feature their special grade mahogany pattern lumber, which is furnished as cheap as white pine.

The Riehl Manufacturing Company, 5411 Bower avenue, S. E., Cleveland, Ohio, have taken space in which to advertise their wire, tampico, fiber or bristle wheel brushes.

The W. W. Oliver Manufacturing Company, 1499 Niagara street, Buffalo, N. Y., advertise a high-class rolling mill for hand use, which is completely described in their Bulletin No. 10.

The Hawley Down Draft Furnace Company, Chicago, Ill., continue their extensive advertising of their new "Cliff O. K." (Oil Krucible) furnace, which they are ready to install in any reputable foundry on trial at their own risk.

A card in this issue directs attention to the laboratory of Ledoux & Company, 99 John street, New York, which is one of the best equipped and most widely known laboratories making a specialty of anaylses in all metals and alloys.

The Cleveland Platers' Supply Company, 1838 Central avenue, S. E., Cleveland, Ohio, offer in their advertisement to send a booklet containing valuable information about cleaning metals to those who are interested in the subject.

The Bilz Sand Mixing & Sifting Company, 1314 Findlay avenue, New York, illustrate their new and improved automatic sand-sifting and mixing machine in their advertisement this month. This machine will handle 100 tons of sand per hour.

On the front cover of this issue the United States Electro-Galvanizing Company illustrate a fine, large installation of patent automatic pipe and bar iron, with which they equipped the Safety Armorite Conduit Company's West Pittsburg plant.

The Electrical Alloys Company, Morristown, N. J., announce on another page that they have unexcelled facilities for drawing, tinning and slitting metals of all kinds. This firm is in a position to furnish almost any kind of resistance materials, metals or alloys that may be required.

The Ideal Furnace Company, 1409 Pennsylvania Building, Philadelphia, Pa., are again calling the attention of foundrymen to the fact that they are selling the Ideal furnace backed by a positive guarantee to make an appreciable reduction in the cost of melting copper, brass, bronze, etc. Full particulars are given in their catalog "I F."

The Dow Chemical Manufacturing Company, of Mansfield, O., and Bridgeport, Conn., are advertising their type "D" tank rheostats. The patents on these rheostats are owned by the Dow Company, who state that this type has been particularly successful for use in tank regulation in plating plants, where several different solutions are in use.

The Knickerbocker Foundry Company, who have an up-to-date plant at 348 West 12th street, New York, have taken space in which to advertise their facilities for making aluminum, brass and bronze castings. The firm is composed of Louis Schanz, president, and A. P. Chavent, vice-president and secretary. One of the firm's specialties is gold and silver castings.

The American Toy & Novelty Manufacturing Company, 125 Indiana street, Chicago, Ill., whose card appears in this issue, are builders of toy stoves and ranges, safes, etc., in the toy lines only. They also make special hardware, such as kick and push plates and railings of all kinds. In connection with their plant they operate the largest electro plating plant in Chicago, also a large brass foundry, tin plate, japaning and enameling department.

Mineral Cleaner, a new preparation for cleaning metal goods before plating, and said to be entirely different from anything on the market, is being manufactured by the Electric Smelting & Aluminum Company, Lockport, N. Y., who state that this cleaner is free from fat and oil, will not injure the hands, removes all buffing dirt, etc., with very little trouble, and is not only cheaper than potash and other cleaners, but does more and better work. The manufacturers will send free samples and quotations to metal manufacturers who are interested.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

		September 8, 1910. Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, Aug. 1, 1910.....		170,640,678
Production of marketable copper in the United States from all domestic and foreign sources during August, 1910.....		127,803,618
		298,444,296
Deliveries:		
For domestic consumption.....	67,731,271	
For export	61,831,780	
		129,563,051
Stocks of marketable copper of all kinds on hand at all points in the United States, Sept. 1, 1910..		168,881,245
Stocks decreased during the month of August.....		1,759,433

METAL MARKET REVIEW

NEW YORK, Sept. 8, 1910.

COPPER.—The price of standard copper in the London market has advanced about £1 per ton during the month. Prices fluctuated within a range of £1 per ton and the trading has been quite active.

In New York we have had a steady to firm market all the month. The talk of restricted production has had the effect of sending consumers into the market and the buying both for home trade and export has been quite active. This is about the first time on record that the leading selling interest has not pegged up the price on an active buying movement. This policy has resulted in more sales to consumers than the old way of rushing the price up on any indication of a home demand. Some of the larger mines will probably cut down their production 10 to 15% but beyond that there is no evidence of any hard and fast agreement, although Wall Street will probably continue to give out tips to that effect.

The European statistics for the first time in many months show an increase in their visible supply of 750 tons during the last half of August. The exports from here during the month were fairly heavy, 27,976 tons against 22,916 tons a year ago, The total exports for the eight months of 1910 are 180,218 tons against 205,442 tons during the same period of 1909.

Prices during the month have been held very steady. Lake is quoted at 12⅞, Electrolytic 12⅝, Casting brands 12½ cents.

PIG TIN.—The pig tin market in London has been in the grip of a powerful syndicate and prices have been advanced at will. Spot tin opened in London at £150. Prices were run up to £166 and close at £163. In the New York market prices during the month were pushed up 3 cents per pound but at the close the market was a little easier, and the net advance for the month was close to 2¾ cents per pound. The American consumer has been left on this advance and will have to come in and pay the price asked by the London speculators.

The deliveries into consumption were 3,700 tons, the visible supply of tin was about 500 tons more than a month ago and about 1,239 tons less than a year ago. How long this bull syndicate is going to hold out is impossible to say. The price to-day is around 35¾ cents and can easily be put to over 36 cents if the powers so order. Future tin can be bought considerably below the spot price and some consumers are in this way protecting themselves against future advances. The advance was entirely unjustifiable and is a matter of manipulation. Spot tin to-day is held at around 36 cents, September delivery 35¾, October 35 cents.

LEAD.—The foreign lead market holds at around £12 10s.

The Trust price has been kept at $4.40 New York 50-ton lots, while carload lots have brought about 5 to 10 points higher. Carloads New York $4.45 to $4.50. East St. Louis the market is around $4.30 to $4.35.

SPELTER.—The London spelter market seems to be pegged at around £22 15s.

In New York the spelter market has been firmer and prices have advanced about ¼ cent per pound from 5¼ to 5½ New York and from 5 cents in East St. Louis to close to 5¼ to-day.

ALUMINUM.—The market has been dull and easier owing to the lessened demand from the automobile makers. Prices to-day for 98 to 99% ingots range from 22 to 22½ cents, according to quantity and deliveries. Small lots are from 23 to 24 cents.

ANTIMONY.—The London price of Halletts is £29 10s against £29 a month ago.

In the New York market antimony is very dull. Cooksons 8¼, Halletts 7⅞, Chinese around 7⅜, and Hungarian 7¼ cents.

SILVER.—In the London market silver is about ¼d. lower than a month ago at 24 5/16d against 24 9/16d opening. In New York prices are about ⅝ cent lower, opening at 53¼ and closing at 52⅝.

QUICKSILVER.—Wholesale lots are quoted at $46.00 and jobbing lots at $47.00 to $47.50.

PLATINUM.—The market holds firm at $36.00 for hard and $34.00 for ordinary.

SHEET METALS.—There has been no change in the base price of sheet copper, brass or wire. Sheet copper 18 cents base, wire 13 cents, seamless brass tubing 18 cents, copper tubing 22 cents and sheet brass 14 cents.

In old metals there has been a rather better demand, and prices are about the same as a month ago.—J. J. A.

THE AUGUST MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
COPPER.			
Lake	12.85	12.65	12.75
Electrolytic	12.70	12.50	12.60
Casting	12.60	12.45	12.50
TIN	33.20	36.15	34.15
LEAD	4.45	4.45	4.45
SPELTER	5.45	5.25	5.40
ANTIMONY (Hallett's)	8.25	8.15	8.20
SILVER	.53¼	.52⅜	52.75

WATERBURY AVERAGE

The average price of lake copper per pound as determined monthly at Waterbury, Conn.

1909.—Average for year, 13.416. 1910.—Jan. 13⅞. Feb. 13⅞. March 13¾. April 13¼. May 13. June 12¾. July 12¾. Aug. 12¾.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Metal Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

INFORMATION BUREAU

Any firm intending to buy metals machinery or supplies and desiring the names of the various manufacturers and sellers of these products can obtain the desired information by writing to THE METAL INDUSTRY. Commercial questions are answered by return mail. Our Information Bureau is for the purpose of answering questions of all kinds. Address THE METAL INDUSTRY, 99 John street, New York.

INQUIRIES AND OPPORTUNITIES

Under our directory of "Trade Wants" (published each month in the back advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds. See Want Ad. pages.

Metal Prices, September 12, 1910

NEW METALS.

	Price per lb. Cents.
COPPER—PIG, BAR AND INGOT AND OLD COPPER. Duty Free, Manufactured 2½c. per lb.	
Lake, carload lots	12.85
Electrolytic, carload lots	12.75
Casting, carload lots	12.50
TIN—Duty Free.	
Straits of Malacca, carload lots	35.65
LEAD—Duty Pigs, Bars and Old, 2½c. per lb.; pipe and sheets, 2¾c. per lb.	
Pig lead, carload lots	4.50
SPELTER—Duty 1⅜c. per lb. Sheets, 1⅝c. per lb.	
Western carload lots	5.50
ALUMINUM—Duty Crude, 7c. per lb. Plates, sheets, bars and rods, 11c. per lb.	
Small lots	28.00
100 lbs. lots	25.00
Ton lots	22.50
ANTIMONY—Duty 1½c. per lb.	
Cookson's, cask lots, nominal	8.25
Hallett's, cask lots	7.85
Other cask lots	7.25
NICKEL—Duty Ingot, 6c. per lb. Sheet, strips and wire 35% ad valorem.	
Shot, Plaquettes, Ingots, Blocks, according to quantity	.45 to .60
MANGANESE METAL—Duty 20%	.80
MAGNESIUM METAL—Duty 3 cents per pound and 25% ad valorem	$1.75
BISMUTH—Duty free	2.10
CADMIUM—Duty free	.80
	Price per oz.
GOLD—Duty free	$20.67
SILVER—Duty free	.52⅞
PLATINUM—Duty free	33.25
QUICKSILVER—Duty 7c. per lb. Price per pound	64c. to 66c.

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
11.00 to 11.25	Heavy Cut Copper	12.00 to 12.25
10.50 to 10.75	Copper Wire	11.50 to 11.75
9.50 to 9.75	Light Copper	10.50 to 10.75
10.00 to 10.25	Heavy Mach. Comp.	11.00 to 11.25
7.50 to 7.75	Heavy Brass	8.00 to 8.25
5.50 to 5.75	Light Brass	6.50 to 6.75
7.00 to 7.25	No. 1 Yellow Brass Turnings	7.75 to 8.00
8.25 to 9.00	No. 1 Comp. Turnings	9.25 to 9.50
3.90 to 4.00	Heavy Lead	—— to 4.25
3.75 to 3.90	Zinc Scrap	—— to 4.25
5.00 to 5.50	Scrap Aluminum, turnings	5.00 to 6.50
10.00 to 12.00	Scrap Aluminum, cast, alloyed	11.00 to 13.00
14.00 to 15.00	Scrap Aluminum, sheet (new)	16.00 to 18.00
19.50 to 20.00	No. 1 Pewter	23.00 to 24.00
25.00 to 27.00	Old Nickel	28.00 to 30.00

INGOT METALS.

	Price per lb. Cents.
Silicon Copper, 10% to 20% ... according to quantity	28 to 35
Silicon Copper, 30% guaranteed. " "	38
Phosphor Copper, 5% " "	19 to 21
Phosphor Copper 10% to 15%, guaranteed " "	28 to 30
Manganese Copper, 30% " "	30 to 35
Phosphor Tin " "	34 to 36
Brass Ingot, Yellow " "	9 to 10
Brass Ingot, Red " "	11 to 12½
Bronze Ingot " "	10 to 11
Manganese Bronze " "	17 to 19
Phosphor Bronze " "	13 to 16
Casting Aluminum Alloys " "	29 to 35

PHOSPHORUS—Duty 18c. per lb.
According to quantity ..... 30 to 35

PRICES OF SHEET COPPER.

BASE PRICE, 18 Cents per Lb. Net.

PRICES MENTIONED BELOW ARE FOR QUANTITIES OF 100 LBS. AND OVER.

SIZE OF SHEETS.		64 oz. and over 50 lb. sheet 30 x 60 and heavier.	32 oz. to 64 oz. 25 to 50 lbs. sheet 30 x 60.	24 oz. to 32 oz. 18¾ to 25 lb. sheet 30 x 60.	16 oz. to 24 oz. 12½ to 18¾ lb. sheet 30 x 60.	14 oz. and 15 oz. 11 to 12½ lb. sheet 30 x 60.	12 oz. and 13 oz. 9½ to 11 lb. sheet 30 x 60.	10 oz. and 11 oz. 7⅞ to 9⅛ lb. sheet 30 x 60.	8 oz. and 9 oz. 6¼ to 7⅛ lb. sheet 30 x 60.	Lighter than 8 oz.
		Cents Per Pound Over Base Price for Soft Copper.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	1	2	3	6	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	3	6	9	
	Longer than 96 inches.	"	"	"	"	2	6			
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	"	"	2	4	7	10	
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	2	6	9		
	Longer than 96 inches. Not longer than 120 inches.	"	"	"	1	3				
	Longer than 120 inches.	"	"	1	2					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	"	1	2	4	7	10		
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	5	8			
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	8				
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	6	11			
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	9				
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins.	Not longer than 132 inches.	4	6							
	Longer than 132 inches.	5	8							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, SEGMENTS AND PATTERN SHEETS, advance over prices of Sheet Copper required to cut them from. 3 cents per pound.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot, and heavier, add ..... 1 " " "

COLD OR HARD ROLLED COPPER, lighter than 14 oz., per square foot, add ..... 2 " " "

POLISHED COPPER, 20 INCHES WIDE and under, advance over price for Cold Rolled Copper of corresponding dimensions and thickness ..... 1 " " sq. ft.

POLISHED COPPER, WIDER THAN 20 INCHES, advance over price for Cold Rolled Copper of corresponding dimensions and thickness ..... 2 " " " "

COLD ROLLED COPPER, PREPARED SUITABLE FOR POLISHING, same as Polished Copper of corresponding dimensions and thickness.

COLD ROLLED AND ANNEALED COPPER SHEETS OR CIRCLES, same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

ROUND COPPER ROD, ⅜ inch diameter or over ..... **Base Price.**

(Rectangular, Square and Irregular Shapes, Copper Rod, Special Prices.)

ZINC—Duty, sheet, 1¼c. per lb.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	7.50 less 8%
Casks	8.00
Open casks	8.50

Metal Prices, September 12, 1910

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect June 27, 1910, and until further notice.

To customers who purchase less than 40,000 lbs. per year and over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13¼	$0.14¾	$0.16¾
Wire	.13¼	.15½	.17
Rod	.13¼	.15½	.18
Brazed tubing	.18⅝	—	.20½
Open seam tubing	.16⅝	—	.18½
Angles and channels, plain	.16⅝	—	.18½

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

To customers who purchase less than 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14½	$0.15¾	$0.17¾
Wire	.14¼	.16½	.18
Rod	.14¼	.16½	.19
Brazed tubing	.19⅝	—	.21½
Open seam tubing	.17⅝	—	.19½
Angles and channels, plain	.17⅝	—	.19½

5% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

14c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	18½c.	per lb. base.
100 lbs. to 300 lbs. in one order	19c.	" " "
Less than 100 lbs. in one order	20½c.	" " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ in O. D. Nos. 4 to 13 Stubs' Gauge, 18c. per lb.
Seamless Copper Tubing, 21c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron Pipe Size	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb.	26	25	20	19	18	18	18	18	18	18	18	19	20	22	24	25

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$5	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1¼ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	60

Discount 55 and 5%.

PRICES FOR MUNTZ'S METAL AND TOBIN BRONZE.

Muntz's or Yellow Metal Sheathing (14" x 48")	14½c.	net base
" " " Rectangular sheets other than Sheathing	16½c.	" "
" " " Rod	14½c.	" "
Tobin Bronze Rod	16c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bars in the rough, 22¼c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Not over 18 in. in width, not thinner than 23 B. S. Gauge, 2c. above price of pig tin in same quantity.

Not over 35 in. in width, not thinner than 22 B. S. Gauge, 3c. above price of pig tin.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

	Wider than..... 3in.	6in.	14in.	16in.	18in.	20in.	24in.	30in.	36in.
	and including..... 12in.	14in.	16in.	18in.	20in.	24in.	30in.	36in.	40in.
	in coils.								
No. 13 and heavier	34	34	36	36	36	36	39	39	39
" 14	34	34	36	36	36	36	39	39	39
" 15	34	34	36	36	36	36	39	39	39
" 16	34	34	36	36	36	36	39	39	39
" 17	34	34	36	36	36	36	39	39	39
" 18	34	34	36	36	36	36	39	39	42
" 19	34	34	36	36	36	36	39	40	43
" 20	34	36	36	36	36	38	41	42	44
" 21	34	38	38	38	38	40	43	44	50
" 22	34	38	38	38	40	40	43	47	51
" 23	34	38	38	38	40	40	43	49	52
" 24	34	38	40	42	42	42	45	51	54
" 25	36	39	41	43	43	43	46	53	57
" 26	36	39	42	46	46	46	51	55	61
" 27	36	40	44	48	48	49	54	58	64
" 28	36	40	46	48	49	49	56	62	67
" 29	38	41	48	50	52	52	61	67	72
" 30	38	42	50	52	56	62	69	72	77
" 31	43	47	55	58	63	71	74	77	83
" 32	45	49	57	61	69	77	91	90	95
" 33	47	51	60	65	73	84	91	100	110
" 34	50	55	62	70	78	91	108	110	120
" 35	..	65	70	80	90	100	115	125	..
" 36	..	80	90	100	115	120	135	..	..
" 37	..	104	114	129	144	159	174	..	..
" 38	..	124	139	154	169	184	204	..	..
" 39	..	144	164	184	204	224	..	..	..
" 40	..	174	204	224	244	..	..	..	..

In flat rolled sheets the above prices refer to lengths between 2 and 3 feet. Prices furnished by the manufacturers for wider and narrower sheet. All columns except the first refer to flat rolled sheet. Prices are 100 lbs. or more at one time. Less quantities 5c. lb. extra. Charges made for boxing.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 25 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	27	24	..	..	14	20	10	9	16	23
12.	.109.	..	..	..	..	..	..	..	26	..	..	..	15	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..
16.	.065.	..	..	..	..	..	28	27	27	24	23	21	21	21	27	31	57	
18.	.049.	..	..	..	..	33	30	29	28	25	26	26	26	..	..	..	..	..
20.	.035.	117	..	46	39	34	33	32	30	29	30	30	30	31	38	49	58	81
21.	.032.	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	138	98	48	42	38	37	35	34	..	..	45	..	..	..	..	..	..
24.	.022.	188	133	108	88	79	73	62	60	68	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge.	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price, per lb....	32	32½	32½	33	33½	34	34½	35	36	37	38	43	46

200 lbs. to 30,000 lbs., 3 cents off list; 30,000 lbs. and over, 4 cents off list.

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4	per cent.	to No.	19,	B. & S.	Gauge, inclusive	$0.60
6	"	"	19,	"	"	.70
9	"	"	19,	"	"	.85
12	"	"	19,	"	"	1.00
15	"	"	19,	"	"	1.15
16	"	"	19,	"	"	1.20
18	"	"	19,	"	"	1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICE OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 2c. below to 6c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2c. to 3½c. above the price of bullion.

ALUMINUM COMPANY OF AMERICA

PITTSBURGH, PA.

ALUMINUM

SHEET TUBING
EXTRUDED SHAPES
ROD RIVETS WIRE
ELECTRICAL CONDUCTORS

Branch Offices

NEW YORK—99 John St.
BOSTON—131 State St.
CHICAGO—Old Colony Bldg.
PITTSBURGH—2344 Oliver Bldg.
PHILADELPHIA—320 Witherspoon Bldg.
ROCHESTER—406 Powers Block
CLEVELAND—719 Garfield Bldg.
WASHINGTON—514 Nat. Met. Bk. Bldg.
DETROIT—1515 Ford Bldg.

DIRECTORY

METAL ROLLING MILLS.

INGOT, PLATE, SHEET, ROD, WIRE, TUBE, METAL GOODS.

HENDRICKS BROTHERS
Manufacturers of
Sheet and Bar Copper
COPPER FIREBOX PLATES
and STAYBOLTS
WIRE and BRAZIER'S RIVETS
IMPORTERS AND DEALERS IN
INGOT COPPER, BLOCK TIN,
SPELTER, LEAD, ANTIMONY
BISMUTH, NICKEL, Etc.
49 Cliff Street, NEW YORK

Established 1802 Cable Address: "Scovill"
SCOVILL MFG. CO.
WATERBURY, CONN.
THE LARGEST AND MOST FULLY EQUIPPED BRASS ROLLING MILLS AND METAL GOODS MANUFACTURING ESTABLISHMENT IN THE WORLD
Estimates for Specialties in Brass, German Silver and Aluminum furnished on application. DEPOTS:
NEW YORK: 75 Spring St. BOSTON: 170 Summer St. CHICAGO: 210 Lake St.

WATERBURY BRASS CO.
General Offices, Mills and Factories.
Waterbury, Conn.
NEW YORK OFFICE, 99 JOHN STREET.
Providence (R. I.) Store, 131 Dorrance St.
Shipments Upon Receipt of Order From Large Stock of
SEAMLESS DRAWN BRASS AND COPPER TUBING
BRASS {SHEET ROD WIRE} COPPER {SHEET ROD WIRE}
GERMAN SILVER {SHEET ROD WIRE} AT WATERBURY

Non-Corrosive Finest Quality
COPPER AND YELLOW
(Muntz) Metal
Naval Brass
Naval Bronze
Manganese Bronze
Plates, Sheets, Bolts, Bars, Rods, Nails, Tacks, &c.
Taunton-New Bedford Copper Co.
NEW BEDFORD, MASS.
71 Water St., New York 61 Batterymarch St., Boston

C. G. HUSSEY & CO.
PITTSBURGH, PENNA.
Manufacturers of
COPPER
In Sheets, Plates, Rolls
ANODES
Tacks and Nails

"BRIDGEPORT" BRONZE ROD
Manganese Bronze
Aluminum Bronze
Phosphor Bronze
Silicon Bronze
SEAMLESS BRASS and COPPER TUBING
Brazed Brass Tubing
Sheet Brass—Sheet Copper
German Silver—Brass and Copper Rods
BRIDGEPORT BRASS CO., Manufacturers
BRIDGEPORT, CONN.

BRASS and COPPER in Sheets and Rolls
SILVER PLATED METAL (for Coach Lamps)
BRITANNIA METAL
B. & M. BABBITT METAL for Bearings
LINING METAL for Automobile Bearings and Copper for Electrical Purposes
H. K. & F. S. BENSON
GLEN RIDGE, N. J.

THE SEYMOUR MFG. CO.
SEYMOUR, CONN.
German Silver
BRASS, COPPER and BRONZE IN SHEETS, WIRE, RODS and TUBES
COPPER AND NICKEL ANODES
Resistance Wires, Wire, Shot Copper

A. H. Wells & Co.
WATERBURY, CONN.
MANUFACTURERS OF
SEAMLESS..... NICKEL SILVER, BRASS, COPPER, BRONZE AND PURE COPPER **TUBING**
TUBING FOR ELECTRICAL PURPOSES
Odd and Special Shapes, and Small Tubing, a Specialty
—ALSO THE—
Bourdon Steam Gauge Springs
All sizes from 8 to 36, B. & S. Gauge.

The Ansonia Brass and Copper Co.
99 JOHN ST., NEW YORK
MANUFACTURERS OF
BRASS and COPPER Sheets, Tubes, Rods and Wire
SOLE MANUFACTURERS TOBIN BRONZE
(Trade-Mark Registered)

PHENIX TUBE CO.
Manufacturers of
Brass and Bronze Iron Lined Tubes
Brazed Steel Tubes,
Round and Square.
Main Office and Mills: Brooklyn, N. Y. City Branch Offices: Chicago, San Francisco

THIS SPACE FOR SALE!
SEND FOR RATES

"RIVERSIDE" German Silver
Phosphor Bronze
Sheets, Rods, Wire, Ingots, Castings, Jewelers' Bars and Alloys
The Riverside Metal Co.
Riverside, Burlington Co., N. J.

SPECIAL SHAPES
Wire Drawing, Tinning, Slitting
In
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OLD METALS GENERALLY

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Pat'd March 25, 1902.

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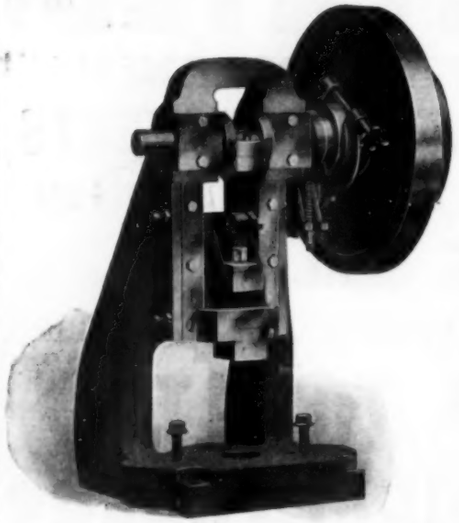

No. 100 Bench Press (3911)

These presses are designed to use for work the nature of which necessitates stopping the machine between strokes to handle the product. Other small bench presses for continuous running are described in Catalogue M.

The accompanying illustration shows the Standard Press arranged for mounting on the bench. It is our intention to keep these presses on hand at all times ready for prompt shipment. The bottom of the gate is arranged with a punch holder for receiving the punch. This punch holder is left blank, unless the customer specifies with his order that he wishes a hole put in it, and gives the dimensions for the hole. The bed of the press is provided with die bed bolts and die bed bolt holes as given in the specifications. A hole is also tapped in the bed immediately back of the center of the press for the purpose of attaching a stripper post or other device.

THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

Waterbury, Connecticut, U. S. A.

Cleveland Office: 1012 Williamson Building

Philadelphia Office: Real Estate Trust Building

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Not to look at nor to hoard, but for the glorious privilege of being independent—here are "helps."

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If you are buffing stove nickel plates, panels, range skirts with deep backgrounds, and have not tried Stevens' SILVER FINISH, you have missed an opportunity.

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You see, I make compositions for specific purposes; state your case and I have the prescription.

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